RELATING MEASURES OF SELECTING AND TRAINING TO A MEASURE OF OUTCOME EXPECTATIONS IN A DOCTORAL PROGRAM

By

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Abstract of Dissertation Presented to the Graduate Council of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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The purpose of this study was to develop information showing the relationship of one outcome measure, the general written qualifying examination, to measures of selection and training of doctoral students in the University of Florida College of Education. The qualifying examination was comprised of five academic areas. The areas were: educational administration, psychological foundations of education and personnel services, sociological foundations of education, curriculum and instruction, and philosophical and historical foundations of education.

The procedures of this study included developing a set of five linear equations to yield the combination of selection and training measures most predictive of success in each of the five academic areas tested on the qualifying examination. A hierarchical clustering technique was then used to group the five equations in terms of their homogeneity to determine the extent and pattern of predictive agreement

between the five academic areas. The clustering procedure ultimately produced a single equation from the original five to achieve prediction of composite success with maximum predictive efficiency. The predictive qualities of three subsets of variables, pre-admission variables, post-admission variables, and program variables, were also investigated.

The population for this study was all 357 doctoral students who took the general qualifying examination in the College of Education during the years 1963 through 1969. A total of 78 independent variables were investigated. These variables were of two forms: 45 were obtained directly from the student files, and 33 were formulated by combinations of directly obtained variables. The criteria were scores received in each of the five academic areas of the qualifying examination. Since students were scored by two graders in each academic area the effective number of cases was 714.

The equations developed for prediction of each area of the examination ranged from 19 percent to 29 percent in maximum predictive ability. The combination and weighting of predictor variables for each of the five equations was rather unique upon inspection. This uniqueness was supported by a difficulty in grouping the equations into common predictive clusters. An equation to predict the average of all areas on the examination had a maximum predictive ability of 36 percent. The predictive qualities of each of the three subsets of variables referred to above were highly significant in overall prediction.

Several conclusions were drawn from this study. First, looking at just the variables, the importance of grades in doctoral study as a predictor variable in all areas was noted. This importance suggested that grades could be a very reliable means of detecting difficulty in doctoral study. Two other variables were somewhat common in adding to multiple prediction. These variables were score on the Verbal Aptitude Test of the Graduate Record Examination (GRE) and the square of an applicant's age. Several variables were also cited because of their lack of predictive ability. One such variable was the score on the Quantitative Aptitude Test of the GRE. Either the quantitative score of the GRE was of little value in predicting desired outcomes in these doctoral students, or the skills predicted by the quantitative score of the GRE, though desirable, were not tested on the qualifying examination.

Second, looking at the equations, the uniqueness of each area equation suggested that a particularlized admission procedure depending on prospective major would be profitable. Since the average of all areas was more predictable than any single area, it is possible that considerable variation existed among the graders in each area. It was mentioned that such possible variation could be reduced by the adoption of standardized testing procedures on the qualifying examination.

CHAPTER I

THE PROBLEM

Professional educators are increasingly aware of the importance of having a system of accountability at all levels of education. This awareness has been noted by several sources (Barro, 1970; Florida Assessment Plan, 1971; Lessinger, 1970; Lieberman, 1970). Accountability has frequently been presented in the literature as a management approach to education characterized by three primary operational phases: input, process, and output (Barro, 1970; Durstine, 1970; Manning, 1970). The essence of accountability is to provide a basis for management procedures in education which will ultimately reconcile the input of personnel, money, and material with the output of desired student development. The goal of establishing accountability is to maximize the efficiency of an educational program by providing policy makers with reliable feedback information on which to base decisions.

Durstine (1970), Lieberman (1970), and Manning (1970) have suggested that, in order to provide the kind of information which will permit more effective decision making, an informational scheme or framework is necessary. That is, some comprehensive structure for integrating information from measures of input, process, and output is requisite to assessing which choices within the limits of available

resources are most likely to result in desired outcomes. The very basis for responsible decision making is adequate determination of possible outcome effects among the choices for the decision. For example, a responsible decision in a matter of policy requires reasonable a priori evidence that the policy being considered for adoption will most effectively and efficiently bring wanted results.

Durstine (1970) also pointed out that the problem of organizing information into relational patterns is of prime importance in the whole question of accountability. He recognized that valid measures of accountability are critical to successful management, but he indicated that their intended purposes can be served only if they are synthesized ". . . into an informational base for decision making" (p. 236). Though Durstine was talking about an accountability information system in a general sense, there is specific concern for creating better developed systems of information for management purposes in graduate education. This concern has been reflected in several recent reports of national scope (Burns, 1970; Carnegie Commission, 1968; Manning, 1970; U. S. Dept. of HEW, 1969). Additionally, the report by Burns (1970) suggested that graduate education at the doctoral level encompasses the same difficulties as graduate education in general except that the difficulties are likely to be more acute at the doctoral level.

The national need to establish an information system for graduate education creates a task for graduate institutions since they are an obvious source of such information. In the first place, it is important that graduate institutions collect, maintain, collate, and

disseminate basic information related to their operation as input to more global information systems. Secondly, graduate institutions should develop information systems for their own policy making in order to attain maximum return on allocated resources.

The first task is primarily one of cataloging. This does not imply, however, that it is a simple clerical procedure. Developing a systematic file system requires very careful design and evaluation through time to determine which information to file and in what form and order. The second problem requires some means of integrating cataloged information to reveal relational patterns between accountability measures.

As shown by Barro (1970), integrating accountability measures to show patterns of relationships places demanding requirements on the integrating procedures. The procedures should permit: (a) a large number of cases to be processed, (b) multiple factors to be considered, (c) interactions between factors to be considered, and (d) empirical comparisons of strength of relationships to be made. A set of basic procedures which meets these requirements has been described by Ward (1962) and Bottenberg & Ward (1963) in the form of a series of applications for fixed-effects linear regression techniques. More specific applications of the Bottenberg & Ward techniques reported by Bottenberg & Christal (1968) and by Christal (1968a, 1968b) offer extremely powerful tools for integrating accountability measures. Bottenberg, Ward, and Christal developed their procedures while on contract to the U. S. Air Force primarily to satisfy management requirements for information on which to base personnel decisions. Their techniques in

general have been used extensively and successfully by the Air Force in accountability situations involving utilization of personnel. An opportunity exists to apply these techniques to alleviate a difficulty in the University of Florida College of Education.

The College of Education has no integrated information relating any outcome measure to measures of selection and training in doctoral study. Fairly extensive student records are available in the college which provide an information source for accountability measures, but the information has never been systematically collated and integrated into relational patterns. One outcome measure, the general written qualifying examination, was administered to all doctoral students in a standard way through the period 1963-1969. During this time, 357 students took the examination.

Writing about the examination in an earlier time, Molbert (1960) reported that this examination was both a measure of achievement and a learning device. Though there was a variety of opinions among surveyed faculty and students about the meaning of the examination, the majority of both perceived the examination as a measure of achievement. Molbert saw as a problem a lack of information about the relationship of the examination to other program variables. Her study recommended that further investigations be conducted to alleviate this problem. Since the examination was virtually unchanged from the time of Molbert's study to the time of interest in this study, her findings and recommendations are still relevant.

In another older but still pertinent study, McBride (1951) showed that a lack of information about the relationship between

outcome expectations and selection and training procedures in doctoral programs was a traditional and universal problem. Manning (1970) indicated that the lack of this type of information is still a major problem in graduate study.

The Problem Stated

There is currently no organized information available in the University of Florida College of Education relating any outcome measure to measures of selection and training in doctoral study. This is not only a local problem but part of a larger national problem. Information of this type is the basis of accountability information systems and is essential to effective management decision making. The purpose of the present study is to provide information showing the relationship of one outcome measure, the general written qualifying examination, to measures of selection and training of doctoral students. Specifically, this study developed a set of five linear equations showing the combination of selection and training measures most predictive of success in each of five academic areas tested on the general qualifying examination. The measure of success was the individual grade assigned by each faculty member grading a question in a particular area. A hierarchical clustering procedure was then used to cluster the five equations in terms of their homogeneity to determine the extent and pattern of predictive agreement between the five academic areas. The clustering procedure also produced a single equation from the original five to synthesize the prediction of composite success with maximum predictive efficiency. Finally, the

predictive qualities of three groups of variables, pre-admission variables, post-admission variables, and program variables, were investigated and reported.

Significance

The problem presented immediately above has two aspects. One aspect is the product, an information base from which management decisions can be made. The other aspect is the process, the techniques or methods used to produce the information base.

The Information Base

As previously mentioned, several recent reports of long-range national scope have indicated the need and intention of gathering information about graduate students, graduate studies, and graduate institution strategies in order to evaluate and make recommendations about graduate education policies (Burns, 1970; Carnegie Commission, 1968; Manning, 1970; U. S. Dept. of HEW, 1969). The primary concern expressed in these reports was that a basis be established for relating means to ends in graduate education. This concern was justified on the basis of the rapidly increasing number of applicants to graduate education and the increasing national urgency to allocate shrinking federal and foundation funds to graduate education in ways most responsive to society's well-being.

Information generated by the present study can complement national studies in two ways. First, it constitutes a fairly comprehensive package of processed information about a population of doctoral students. Such information could be useful as input data

to a national system. Second, planners at the national level will have to make decisions about what types and forms of data to include in a national system. This study has provided a partial basis for indicating what types of data could be usefully included in such a system.

At the local level this study can be directly useful as a base of information for policy decisions. As was indicated, no information exists in the College of Education which shows the relationship between an outcome measure and measures of selection and training of doctoral students. The need for such information has been pointed out by McBride (1951) as a general problem in doctoral programs and Molbert (1960) as a specific problem in the doctoral program in the University of Florida College of Education.

Integrated information relating measures of output to measures of input is fundamental to an accountability system. Though the results of this study only partially contribute to the overall requirement for accountability information at the local level, the information appears adequate for some policy considerations.

As stated before, integrating accountability measures to show relational patterns places demanding requirements on the integrating procedures. Barro (1970) made this point clear when he said success in accountability may depend ". . . on the adequacy of the statistical model in mirroring the underlying (and unknown) input-output relationships in education" (p. 207). Techniques developed by Ward (1962), Bottenberg & Ward (1963), Bottenberg & Christal (1968), and Christal (1968a, 1968b) were used in this study. Their

techniques were developed for personnel management applications in the U. S. Air Force and have been used extensively in accountability situations. To the extent that these techniques were sufficient for the needs of this study, they may also be seen as potentially useful for integrating accountability information in a variety of education adaptations.

Organization of the Remainder of Dissertation

In Chapter I the problem and its signficance have been described. Chapter II provides a review of related literature. The review includes: a brief section on accountability to give perspective to the study, a section on literature dealing with prediction of ratings, and a section on literature dealing with the hierarchical clustering method. The procedures used in this study including a description of the sources of data appear in Chapter III. Chapter IV contains the study of results, and Chapter V contains the discussion of results.

CHAPTER II

REVIEW OF THE LITERATURE

As indicated in the previous section, the literature is reviewed in three areas. First, a brief review of literature on accountability is provided in order to give perspective to the study. Next, literature dealing with prediction is reviewed. Last, a review of literature on the hierarchical clustering procedure is presented. A summary of the reviewed areas concludes this chapter.

Accountability

The notion of accountability in education is not entirely new, but recent emphases and new terminology have brought accountability into focus in professional education. The sources reviewed here are intended to give a brief orientation into accountability and a perspective to this study.

In a summary review of accountability, Lieberman (1970) explained there are several forms of accountability in education, such as: merit pay, voucher systems, and performance contracting. He warned against judging the importance of accountability on the basis of any one of its manifested forms. According to Lieberman, there is a generally common meaning associated with the concept of accountability. He reported that, from a common sense point of view, ". . . there is accountability when resources and efforts are related to results in

ways that are useful for policy making, resource allocation, or compensation" (p. 194).

In addition to having indicated a growing national and even international interest in accountability among educators, the author pointed out that accountability has attracted the attention of governors and legislators across the country. He reported that basically there are only two approaches to accountability. One approach is through relating input to output in some meaningful way within an educational program. The second approach is through consumer choice. Lieberman stated that both these approaches require an adequate information system in order to be effective. Since the present study generated accountability information suitable for policy considerations, it conforms to Lieberman's common-sense definition of accountability and can contribute to the requirement he mentioned for effective accountability information.

Typical of efforts to establish accountability is the report in Florida Assessment Plan (1971). This report is a state-level plan to develop an accountability system in the public schools. For purposes of accountability it conceptualized education in terms of the "industrial model," that is, as comprised of input, process, and product. Principally, the report expressed concern that precise, measurable, and relevant outcome objectives be devised so that the product can be assessed. The position taken in the report was that process cannot be measured directly, but its appropriateness can be inferred from the product. As a first step toward establishing accountability, the Florida Assessment Plan intended to determine outcome objectives for

basic learning skills (such as reading) and for vocational skills. The difficulty of devising outcome objectives for more advanced and more general learning situations was viewed as a problem in the report. It was suggested in the Florida Assessment Plan that future steps toward implementing accountability would follow after consolidating efforts in the first step.

The main point of interest from the Florida Assessment Plan to the present study was the recognized problem of devising outcome objectives for learning situations other than skill acquisition. Since the present study was concerned with accountability information for a doctoral study program, it was assumed that the outcome measure scores on the general qualifying examination were valid within the limits of the "state of the art."

In a proposed methodological approach highly related to the present study, Barro (1970) agreed with Lieberman that there is a generally accepted meaning for accountability in education. Barro, however, stressed the fixing of responsibility as the main theme of accountability rather than Lieberman's theme of justifying means with ends. The rapidly growing interest in and use of accountability in education is seen by Barro as testimony to its usefulness rather than its novelty. He detailed several ways that schools can be made accountable. In addition to those approaches to accountability mentioned by Lieberman, Barro spoke of external evaluation programs and community control. Like Lieberman, Barro indicated that all approaches to accountability depend on adequate information systems to be effective. He stated that two types of information are necessary,

performance measurements and estimated contributions to performance measurements by various individuals and components of the education system. Although he recommended that more and better measures of performance be employed, Barro was more concerned that the performance measures be related to specific teachers, schools, and districts. He seemed somewhat willing to accept presently available measures of performance in order to proceed with the more important problem of relating the performance to the antecedent conditions. The statistical procedure proposed by Barro for relating performance to conditions was regression analysis. He also called for the use of categorical "dummy" variables as well as continuous variables in building appropriate models. He envisioned the following shortcomings to his statistical approach: (a) intercorrelation between supposedly independent variables, (b) omitted variables, (c) structural limitations of the statistical models, and (d) validity.

There was a strong relationship between Barro's proposed methodology and the methods used in this study. Barro's approach was to determine the amount of variation in performance attributable to the teacher, the school, the district, etc., by a regression analysis procedure. The present study concerned more an investigation of systemic variables with a view toward procedures rather than individuals as the sources of variation in performance. The shortcomings in statistical procedures envisioned by Barro in his proposals were also difficulties for this study. However, there were some advantages in using an entire population, a fixed-effects regression model, and the hierarchical clusting procedure which, it was believed,

minimized the shortcomings. Using an entire population reduced the differential effects of intercorrelation between supposedly independent variables since all cases were affected in the same way. Since the fixed-effects regression model permitted investigation of variation due to interaction between variables, one aspect of structural limitations foreseen by Barro was eliminated in this study. Another structural limitation, treatment of only one dimension of output at a time, was reduced by use of the hierarchical clustering procedure.

Lopez (1970), like Barro, stressed holding the individual (teacher, administrator, etc.) accountable, but, unlike Barro, he distinguished this from the question of fixing responsibility. He maintained that responsibility is an element of authority and cannot be delegated. Any lack of success in programs of accountability to date was seen by Lopez as an indictment of the way the programs were handled rather than as an indictment of accountability per se. He proposed that accountability be established by interventions or changes in organizational goals, attitudes of supervisors, and techniques for evaluating individual members of the school system. The basic assumption that everyone who joins an organization does so to further its goals is the key to understanding Lopez's proposed system. He suggested that more effective teaching can be achieved primarily by better measures of teacher performance and better communication between teacher and supervisor. His approach to accountability was somewhat unique in that it relied less on a sophisticated system of information and more on trust and communication between individuals for its effectiveness.

It is difficult to comment on Lopez's proposals in terms of the present study. One fact must be borne in mind, however; Lopez was talking about accountability in public schools. In two reports dealing with accountability in higher education, development of comprehensive information systems to achieve accountability seemed to be favored (Carnegie Commission, 1968; U. S. Dept. of HEW, 1969). The quality rankings of graduate programs and faculties reported by Cartter (1966) indicated that graduate education will probably be more sensitive to an accountability system based on comprehensive information. But, as Lopez contended, trust and communication between individuals will undoubtedly play a part in any effective accountability system, even in graduate education.

The question of accountability in graduate education was shown further in the position of the Graduate Record Examination (GRE) Board as indicated in two reports (Burns, 1970; Manning, 1970). Both of these reports reflected the GRE Board's concern for greater accountability in graduate education. Manning reported the research strategy projected for the 1970s by the GRE Board. According to Manning, ten research areas have been outlined within the following system elements: input energy (talent), distribution (admissions process), modifying functions (educational process), and output measures (graduate school or postgraduate achievement). The purpose for proposing to conduct this research was reported as a series of goals for greater accountability. Burns' report gave the results of a 45-item questionnaire sent to all 287 member graduate schools of the Council of Graduate Schools. The survey dealt with admissions and fellowship granting

policies and was reported in categories based on the number of doctoral degrees awarded in 1967-68. Results of the survey revealed a variety of facts about selection and fellowship awarding policies. One of the most interesting facts in terms of the present study was the tendency of graduate schools to conduct few follow-up studies on the success of their policies.

Of the two GRE Board reports, the report by Manning was perhaps the more pertinent to this study because it dealt with the problem of building an information system for decision making in graduate education. Another publication dealing with development of an information system for accountability in education is given below.

Durstine (1970) was concerned with developing a total accountability information system suitable for all levels of education. The system proposed by Durstine was not anticipated by him to be massive or complex. He did, however, make the point that, in order to be effective, an accountability information system must permit the synthesis of accountability measures into relational patterns suitable for decision making. His contention supported the worth of conducting the present study.

Prediction of Ratings

The outcome measures in this study, grades on the general written qualifying examination, were faculty ratings of student performance. Since the present study predicted these ratings from a combination of factors, literature dealing with prediction of ratings is reviewed here.

Early studies of prediction were correlational studies between the variables of interest and the predictor variables. In one such

investigation, Platz (1959) studied the relationship of five predictor variables and four criterion variables of success among 124 doctoral students. The predictor variables considered were Miller Analogies Test (MAT) score, score on an objective comprehensive test administered at admission, overall undergraduate grade point average, undergraduate average in science and math, and undergraduate average in psychology courses. The criterion variables were graduate honor point average, grade on the doctoral preliminary exam, faculty rating of potential professional contribution, and faculty rating of potential scientific contribution.

Of primary interest for purposes of the present study were correlates Platz found to the doctoral preliminary exam. The single highest correlate was the undergraduate average in science and math. It correlated .27 with the doctoral exam. The highest two-factor multiple correlation was .36 using MAT scores and undergraduate average in science and math.

In another correlational study, Robertson & Nielsen (1961) found the literature to be very disappointing in producing predictors of success in graduate school. Correlations between MAT scores and faculty ratings or graduate grade point averages varied from .16 to .68. They reported that the psychology department at the University of Florida was beginning to show increasing confidence in the aptitude tests of the Graduate Record Examination (GRE) as a predictor of success. Robertson & Nielsen selected 50 doctoral students who entered the department between 1955 and 1959 and had 9 of the 11 faculty rank them on a five-point scale indicating the degree to which the student possessed the intellectual capacity to complete the Ph. D. Only ratings where

the faculty member claimed to have observed some prior tangible evidence of ability in the student were used. These researchers found a correlation of .29 between the average GRE aptitude score and faculty rating. This correlation was higher than that of either of the two aptitude scores (verbal or quantitative) individually, and it was significant. Undergraduate grade point average for the last two years correlated at only .16 and was not significant. The multiple correlation of the average GRE score and the undergraduate average for the last two years was .44 and significant. The predictive possibilities of both first- and last two-year undergraduate averages were investigated in the present study.

Hoyt (1966) looked beyond college and reviewed the literature discussing the correlation between college grades and adult achievement. He reported studies conducted in a number of fields to ascertain the relationship between college grades and later success. Hoyt concluded ". . . that college grades have no more than a very modest correlation with adult success, no matter how defined" (p. 75). The predictive efficiency of a variety of both intellective and non-intellective factors was considered in the present study.

The possibility of predicting ratings or judgments by regression models is a more recent technique. In most cases, linear models are developed because of their comparative ease of computation and accuracy of prediction. Hoffman (1960) in a classic investigation into the possibilities of approximating psychological clinicians' judgments with regression equations found that this could be done quite satisfactorily. He also investigated the relative merits of a

configurational model compared to a linear model for this purpose. His finding was that the linear model was sufficiently accurate to the point that the additional difficulty in using the configurational model did not justify the small increase in accuracy.

Schenck & Naylor (1968) warned of a shortcoming in using regression analysis to capture the strategies of people. The caution stemmed from the tendency for linear consistency to increase as the intercorrelation between pairs of variables increases. Since an entire population was used in the present study, no differential results should have occurred and the effect described by Schenck and Naylor should have been negligible to the relative findings.

In a very recent article, Dawes (1971) explored the possibility of predicting an admissions committee's judgments in the selection of doctoral students in a department of psychology. Dawes was not concerned with attempting to develop a maximally predictive system nor with establishing an ideal criterion. His concern was to establish the utility of a simple linear equation to adequately predict the committee's judgments. He obtained a multiple correlation of .40 with a three-variable linear equation. The variables used were: overall undergraduate grade point average, the total scaled score on the aptitude tests of the GRE, and a crude measure of quality of the undergraduate institution based on the selectivity index in Cass & Birnbaum (1968). Using his model to make decisions on a sample which had already been decided on by the admissions committee, Dawes was able to eliminate 55 percent of those eliminated by the committee with no loss in those accepted by the committee. Dawes contended that such

computerized decisions prove to be less capricious and in the long run more "human" than human judgments.

In a slightly different approach, Shostak (1970) attempted to predict rater policies on an essay examination in English in terms of personal and educational factors about the raters themselves. He first cluster analyzed the examination grades and then factor analyzed the resulting clusters on rater variables. This was an ipsative procedure in that it was assumed the rater's assigned grades varied in accordance with factors not directly considered in the rating process. In other words, it was assumed that the rater had a "within person" distribution of the variables of interest which related to how he arrived at his ratings. The ipsative approach was described by Cattell (1968) and Guilford (1954) in regard to the psychometric procedure of factor analysis, and was used in the present study.

The regression technique used in the present study was based on the fixed-effects model. With this model, there is no assumption that the independent variables are normally distributed; as a result, new variables can be generated from functions of the independent variables. Ward (1962) and Bottenberg & Ward (1963) detailed a variety of computer-assisted predictive and simulative applications for the fixed-effects linear model. A variation of one of these applications was used in this study.

The variation used herein was described and named by Christal (1968b) the "policy capturing model." The essential feature of the policy capturing model as compared to the usual system of building a prediction equation was that all conceptually reasonable variables

and functions of variables were tried out in the system within the limits of time, money, and available data. Christal reported use of the policy capturing model in the Air Force to predict a board's decisions about the grade of officer personnel each of 3,575 jobs in the Air Force required. After examining almost 200 possible variables, Christal reported an ability to predict the judgments of the board of 22 colonels with a 9-predictor system which had a multiple correlation of .92 with the board.

Talbot (1966) also used a fixed-effects linear model to test the predictive value of 36 variables in selecting the 39 of 195 black candidates who received their doctorate. Multiple correlation of predicted successes to observed successes was .38 for the full or unrestricted model. Of the 36 variables, Talbot discovered that only 6 significantly reduced the residual least squares value at the .05 level. Talbot suggested that all 6 of these predictor variables were indicators of academic achievement. He even put prior armed service in this category pointing out that veterans had usually travelled more, been exposed to other cultures, and were often more mature and less provincial. Talbot's study was primarily related to this study because of his use of the fixed-effects linear model which was the basic statistical tool of the present study also.

Hierarchical Clustering

Ward & Hook (1963), Christal (1968a), and Bottenberg & Christal (1968) reported a technique for grouping criteria in terms of the homogeneity of their associated prediction equations. The general

procedure was to develop a prediction equation for each rater or member of a judgment or policy board and then mathematically combine the two equations out of the total group which resulted in the least reduction of overall multiple correlation. This procedure was continued, reducing the total number of equations by one in each of a series of steps until one single equation was produced. The advantages of this technique were that maximum predictive qualities were preserved for a divergent pattern of judgments, and that points of more important differences in judgments could be identified. This technique was called judgment analysis (JAN) by Christal (1968a).

Naylor & Wherry (1965) used the JAN technique for capturing and clustering the policies of raters from ratings of hypothetical people with simulated scores. The authors maintained that this procedure saved time and money since otherwise researchers would have to obtain large numbers of people who had been quantified on each dimension of interest for the raters to rate. Naylor and Wherry indicated that the use of hypothetical ratees seemed worthwhile statistically, but that the actual worth was still under investigation.

Wherry & Naylor (1966) compared a system of clustering which they originated, PROF, with the JAN technique. PROF means a Profile of Factors and was based on a system of factor analysis. The authors argued that even though the JAN technique clustered raters by the similarity of their prediction equations, it did not really analyze their judgments. Their position was that capturing policies and describing policies are two different things. The Profile of Factors procedure they outlined involved identifying and describing factors

of rater variance first and then clustering raters on the similarity of their factors. PROF was considered by the authors to be a somewhat better basis for clustering raters than was JAN, if the rating strategies were to be meaningful and interpretable.

For the purposes of the present study, the strategies of the raters and the meaning of the strategies were not of primary importance since prediction was of all raters in one academic area rather than of individual raters. The main problem was to identify the specific variables which were predictive of ratings in the various academic areas.

Houston (1968) and Houston & Roscoe (1968) asked 20 faculty judges to rate each of 231 recent graduates from graduate education programs on the basis of 21 variables. The former students were rated on a variety of continuous and categorical variables without the faculty knowing whom they were rating. Using these faculty ratings as criterion, a prediction system was developed with the JAN technique yielding a multiple correlation of .93. Houston & Roscoe (1968) then asked the faculty to rate the same students by name only. Using this rating as criterion, the same variables were employed to produce another prediction system by means of the JAN technique. This particular approach the authors called the ipsative variation; the multiple correlation obtained was .42. Houston and Roscoe commented that probably the ipsative variation could not be considered to have captured the policy of the raters in terms of the variables, but was simply a statement of the amount of relationship between the variables and the ipsative JAN criterion.

In another study using the JAN technique, Houston & Bentzen (1969) attempted to capture the teacher evaluation policy of a team

of evaluators. Their approach was to use a modified form of the JAN technique to express the joint policy of the team. They then tested the predictive contributions of one group of variables termed teacher characteristics and another group termed pupil characteristics. Houston and Bentzen reported that a policy had been captured and that the group of variables called teacher characteristics contributed significantly to prediction.

Williams, Gab, & Lindem (1969) tried to capture the policy of a university department concerning admissions to the doctoral program. They had 12 graduate faculty members sort the profiles of 33 graduated doctoral students into seven different sorts (using a Q-sort technique). The profiles consisted of 14 variables including: MAT score, age, and GRE scores. The seven sorts were assigned numerical weightings from 1 to 7 which became the criterion variable for developing a prediction equation for each faculty member. Clustering of the equations by their homogeneity was then accomplished by use of the JAN technique. Results of the clustering indicated that there were at least two and possibly three groups of rating systems among the faculty in making admissions decisions. Williams, Gab, and Lindem reported that the most important aspect of this study was that it revealed to the faculty their perceptions about the admissions variables.

The final example of a use of the JAN technique is a study conducted by Littleton (1970). This study attempted to capture the policy of elementary principals in regard to their predisposition to try selected innovations. Two subsets of variables were identified. One group was variables associated with the perceived characteristics

of the innovation being considered. The other set of variables was associated with characteristics of the power structure into which the innovation was being introduced. The basic findings were that the policies of the principals could be captured and that both groups of variables contributed significantly to prediction.

The predictive qualities of three groups or subsets of variables were tested in the present study. Since the overall prediction equation to which the predictive efficiency of each subset was tested was developed by the JAN technique, Littleton's study was quite similar methodologically to this study.

Summary

Summarizing the literature, the need for accountability in education, including graduate education, seemed apparent. Accountability in general implies some kind of system for reconciling means with ends in education. An essential requirement of virtually all approaches to accountability reviewed was an information system which can indicate relational patterns between accountability measures.

One statistical technique which appeared sufficient for integrating measures of accountability into meaningful relationships was regression analysis. The fixed-effects model in regression analysis seemed particularly appropriate since it permitted functions of variables to be used as variables. The "prediction of ratings" studies reviewed tended to support the contention that regression analysis was adequate for relating a large number of accountability measures with acceptable results.

The studies reviewed in relation to the hierarchical clustering procedure used in the present study indicated that JAN was a powerful and versatile statistical tool. Though diverse in subject, the reviewed studies showed the capability of the JAN technique to cluster criteria by their homogeneity while retaining maximum predictive efficiency.

CHAPTER III

PROCEDURES

The criterion variables for this study were obtained from past administrations of the doctoral written general qualifying examination as recorded in the files of the University of Florida Graduate Studies in Education Office. Therefore, the purposes, practices of administration, and grading policies for conducting the examination have a bearing on the study criteria. So that the nature of the criterion variables might be better understood, an explanation of the general qualifying examination is presented below. Additionally, since information from student files in the Graduate Studies Office formed the basis for the predictor variables of this study, the specific types of information used are given in three general categories. Also, the population of doctoral students studied is described. Next, the procedures in analyzing the data are discussed. Finally, a chapter summary is given.

Explanation of the General Qualifying Examination

The general written qualifying examination has been an integral part of the doctor of education program since the degree was first offered in 1949. Through the spring of 1969, the examination was administered several times a year on a cross-departmental or college-wide basis, with purposes, procedures, and grading policies constant through time.

Purposes

In a previously cited study, Molbert (1960) reported the purpose of the examination was to determine the level of development of certain competencies in the doctoral candidate ". . . both for the professional status the degree represents and for the realization of the individual's potentialities" (p. 4). Her study includes an instruction to the faculty members writing and grading the actual examination to write and grade a question representative of knowledge which ". . . could reasonably be expected of any graduate student at the doctoral level" (p. 291).

Practices of Administration

The complete procedures for administration of the general qualifying examination are presented in Appendix A. Three procedural matters, however, are included here for general understanding.

First, the examination was conducted on a completely anonymous basis. Identity of the faculty members who prepared and graded the questions at each testing was kept completely confidential, before, during, and after actual administration of the examination. Also, identity of the students was linked to their examination papers only by a special code number which was not available to the graders.

Second, for the time period of interest in this study, the qualifying examination included questions in five academic areas of education. These areas were: educational administration, psychological foundations of education and personnel services, sociological foundations of education, curriculum and instruction, and philosophical and historical foundations of education.

Third, at each offering of the examination, a group of ten faculty members was selected to write and grade the examination questions. These ten faculty were chosen in five sets of two with each set having academic competency in one of the five areas covered on the examination. Each set of two faculty members jointly prepared an examination question in their academic area. Later these same two faculty members graded their joint question independently, observing the general grading policies below.

Grading Policies

In arriving at a grade for a question, an individual faculty member assigned a score ranging from 1 to 5 on each of five grading criteria, then averaged these scores to produce the grade score. These individual faculty grade scores were the criterion variables or variables of interest for this study. For more detailed information regarding grading policies see Appendices A and B.

Student Information

As indicated in the introduction to this section, information from the students' files formed the basis for the predictor variables in this study. Presented below are the three informational sources of data and the predictor variables derived from each source. Predictor variables collected from each informational source were of two forms: those obtained directly from the informational source, and those formulated by combinations of directly obtained variables.

Pre-Admission Information

Information available about a student prior to admission for doctoral study constituted this source of data. The predictor variables obtained directly from this source are shown in Table 1. The reason for selecting these predictor variables for investigation was because they generally represented consistently available information which, it was believed, might have some predictive relationship to the criterion grades.

Various combinations of the directly obtained variables above were used to formulate additional predictor variables. The resulting combination variables are shown in Appendix C as functions of the directly obtained variables. Squares of variables were introduced where it was suspected second order curvilinear relationships might exist between predictors and the criteria. Products of variables were included in order to generate interaction predictors where such seemed reasonably appropriate.

Post-Admission Information

Information generated after admission for doctor study was this source of data. Predictor variables collected directly from this source are presented under the appropriate heading in Table 1. Additional variables produced from functions of the directly obtained variables can be seen in Appendix C. These post-admission variables were included for study for the same reasons as the pre-admission variables.

TABLE 1

Definition of Variables Obtained Directly from Study Information Sources

Variable Number	Variable Name	Variable Definition
		Source: Pre-Admission Information
1.	GRE verbal score	The highest scaled score recorded on the verbal aptitude test of the Graduate Record Examination
2.	GRE quantitative score	The same as 1 above except pertains to the quantitative aptitude test
3.	GRE advanced score	The same as 1 above except pertains to the advanced achievement test
4.	MAT score	The scaled score on the Miller Analogies Test
5.	Undergraduate honor point average for the first two years of study	The grade point average based on the 4.0 system of all study prior to that in 6 below
6.	Undergraduate honor point average for the last two years of study	The grade point average based on a 4.0 system of all study in the last 60 semester hours or 90 quarter hours prior to receiving the baccalaureate degree. When part of a term of study was included to total the necessary hours, the entire term was included
7.	Undergraduate major in liberal arts	Yes equals 1, no equals 0

8.	Undergraduate major in science or mathematics	Yes equals 1, no equals 0
9.	Undergraduate major in a professional field	Yes equals 1, no equals 0
10.	Honor point average in Freshman English	The grade point average in Freshman English based on 4.0 system
11.	Number of undergraduate changes	The total number of changes in both undergraduate major and undergraduate institution, changes in major was counted only when fairly obvious from the transcript, movement from a junior to a senior institution was not considered a change
12.	Selectivity factor for institution where Freshman English taken	An assigned numerical factor based on Fine's (1970, p. xix) College Admission Selector where: "most competitive" equals 8, "highly competitive" equals 7, "very competitive" equals 6, "competitive" equals 5, "less competitive" equals 4, "non-competitive" equals 3, "special" equals 2, and not mentioned equals 1.
13.	Selectivity factor for institution where baccalaureate degree received	The same scale as 12 above
14.	Graduation rate factor for institution where Freshman English taken	An assigned numerical factor based on Fine's (1970) percentage figure of freshmen who graduate as shown in the Student Life section under each institution where: 40 percent or less equals 7, 41 to 60 percent equals 6, 61 to 70 percent equals 5, 71 to 80 percent equals 4, 81 to 90 percent equals 3, better than 90 percent equals 2, and 100 percent or virtually 100 percent equals 1

TABLE 1 (continued)

Variable Number	Variable Name	Variable Definition
15.	Graduation rate for institution where baccalaureate degree granted	The same scale as 14 above
16.	Master's degree in education	Yes equals 1, no equals 0
17.	Age	The age of student at admission computed to nearest year
18.	Sex	Female equals 1, male equals 0
19.	Prior military experience	Yes equals 1, no equals 0
20.	High school graduate in Florida	Yes equals 1, no equals 0
21.	Years of teaching experience	Student's experience in teaching, educational counseling, and/or educational administration computed to nearest year at time of admission
22.	Recommendation ratings prior to admission	The average of assigned numerical factors based on the University of Florida Graduate School Letter of Recommendation for 5-63 where: "upper 5 percent" equals 5, "upper 10 percent" equals 4, "upper third" equals 3, "middle third" equals 2, and "lower third" equals 1
23.	Graduate honor point average prior to admission	The grade point average based on a 4.0 system in all graduate study prior to admission

24.	Master's degree received at University of Florida	Yes equals 1, no equals 0

Source: Post-Admission Information

25.	Time in doctoral study	The time between beginning full-time doctoral study and taking the qualifying examination computed to the nearest month
26.	Recommendation ratings after admission	The same scale as 22 above
27.	Major department Foundations	Yes equals 1, no equals 0
28.	Major department Special Education	Yes equals 1, no equals 0
29.	Major department Counselor Education	Yes equals 1, no equals 0
30.	Major department Administration	Yes equals 1, no equals 0
31.	Major department Curriculum and Instruction	Yes equals 1, no equals 0
32.	Remedial study	This was considered automatic if there was more than one testing on the qualifying examination. Yes equals 1, no equals 0
33.	Graduate honor point average after admission	The grade point average in graduate study completed after admission

TABLE 1 (continued)

Variable Number	Variable Name	Variable Definition
34.	Assistantship held	Based on whether the student held a graduate assistantship at any time during doctoral study prior to taking the qualifying examination. Yes equals 1, no equals 0
35.	Fellowship held	Based on whether the student held a fellowship at any time during doctoral study prior to taking the qualifying examination. Yes equals 1, no equals 0
		Source: Graduate Program Information
36.	Honor point average in educational administration	The grade point average based on a 4.0 system of all graduate course work in educational administration
37.	Honor point average in psychological foundations	The same as 36 above except for psychological foundations and personnel services
38.	Honor point average in sociological foundations	The same as 36 above except for sociological foundations
39.	Honor point average in philosophical and historical foundations	The same as 36 above except for philosophical and historical foundations
40.	Honor point average in curriculum and instruction	The same as 36 above except for curriculum and instruction

41.	Total hours of educational administration	The total semester hours of graduate course work in educational administration
42.	Total hours of psychological foundations	The same as 41 above except for psychological foundations and personnel services
43.	Total hours of sociological foundations	The same as 41 above except for sociological foundations
44.	Total hours of historical and philosophical foundations	The same as 41 above except for historical and philosophical foundations
45.	Total hours of curriculum and instruction	The same as 41 above except for curriculum and instruction

Graduate Program Information

Information generated as a result of the total graduate study program comprised this source of data. Predictor variables based on these data are presented in Table 1 and Appendix C. The rationale for inclusion of variables here was the same as for those from the two preceding sources.

Study Population

The population for this study was all doctoral students in the University of Florida College of Education who took the general qualifying examination during the years 1963 through 1969. There were two changes in qualifying examination procedures referred to previously which limited the population to these years. First, a minor change in grading policy was effected in 1963. The change resulted in slightly higher grades on the average from 1963 on, making comparisons with prior grades difficult. Second, at the end of 1969 administration became the responsibility of the individual departments.

No sampling of the study population was necessary. The entire population of doctoral students who took the qualifying examination during the years 1963 - 1969 was used in this study. The total number of students was 357. General characteristics of the population are summarized in Appendix D.

Analysis of the Data

Analysis of the data is considered in two parts. First the study design is given. Then the actual data treatment is presented.

Study Design

As was mentioned in the section explaining the general qualifying examination, the individual faculty grade scores were the criterion variables for the study. Comparisons of these scores between the five academic areas of the qualifying examination revealed a rather low intercorrelation (Table 2). Because of the low intercorrelation, five separate prediction equations were developed, one for each academic area. Next, the equations were clustered in terms of their predictive agreement. The three steps used to accomplish this general design follow.

The first step in the study design was to produce five linear regression equations to predict the grades received in the five academic areas included on the qualifying examination. Since two faculty members in each area independently graded the students tested, the effective number of criterion variables for each area was twice the number of students tested. The five regression equations were developed from the predictor variables by a stepwise regression procedure in accordance with the policy capturing model described by Christal (1968b).

The second step in the study design was to cluster the five prediction equations to produce a single best equation for representing composite success on the examination. The technique employed grouped the equations in terms of their homogeneity while retaining maximum predictive efficiency. Additionally, this clustering process revealed patterns of agreement in outcome expectations between the academic areas.

TABLE 2

Intercorrelation[a] of Scores from the Five Academic Areas of the Qualifying Examination

	Administration	Psychological	Social	Historical - Philosophical	Curriculum
Administration	--				
Psychological	13**	--			
Social	13**	14**	--		
Historical-Philosophical	25**	32**	26**	--	
Curriculum	20**	24**	20**	25**	--

[a]Note: Decimal points have been omitted.
**p < .01

The third step of the study design was to conduct three tests of significance for the predictive qualities of three subsets of variables. The three subsets were: pre-admission variables, post-admission variables, and program variables.

Data Treatment

Computation involved in all multiple regression analyses was performed by an IBM 360 computer. The computer was programmed according to the biomedical stepwise regression procedure, BMD02R (Efroymsen, 1960).

Clustering of the regression equations by their homogeneity was accomplished by a hierarchical grouping technique, JAN (Bottenberg & Christal,1968a; Christal,1968b). Tests of significance in regression of pre-admission, post-admission, and program variables were calculated in accordance with Bottenberg & Ward (1963).

Summary

In summary, the criteria for this study were scores in five different academic areas of the qualifying examination. The examination procedures were rigorous and the purposes reflected a concern for professional standards. The independent variables were drawn from three classifications of information: that available at the time of admission to doctoral study, that generated after admission to doctoral study, and that specifically related to the overall doctoral program of courses. The study population was 357 doctoral students who took the qualifying examination from 1963 to 1969. Analysis of the data involved developing, by a stepwise computer program, five regression

equations, one to predict each of the academic areas of the qualifying examination. These equations were then clustered by a hierarchical grouping procedure to reveal patterns of predictive agreement and to yield a single "best" prediction equation. Finally, the predictive significance of variables from each of the information sources discussed above was tested.

CHAPTER IV

RESULTS

This chapter is composed of three parts. In the first part five multiple regression equations are presented and explained. Each of these equations was a prediction system for the outcome expectations of one academic area as reflected in the scores on that portion of the qualifying examination. Although multiple regression equations are useful because of the predictive qualities of properly weighted combinations of variables, they are not very helpful for describing the factors which appear to underlie measures of outcome (Wherry & Naylor, 1966; Bottenberg & Ward,1963). For this reason the relationship of some individual correlates of the outcome variable with the variables in regression was also examined.

The second section contains the results of a hierarchical clustering procedure which grouped the five equations in terms of their homogeneity. Predictive qualities of each of three subsets of variables, pre-admission variables, post-admission variables, and program variables, are discussed in part three of this chapter.

Multiple Regression of the Five Academic Areas

As was previously mentioned, the multiple regression procedure used was a stepwise linear computer program (Efroymsen, 1960). In

this program an additional variable was added to the regression system in a stepwise manner until either F values or tolerances of remaining variables failed to meet the specified requirements to enter the system. The variable added at each step was the one which resulted in the greatest reduction in residual sum of squares. Since the number of variables in the present study was quite large, the number of steps in the regression analysis was commensurately large.

In order to keep the presentation of data to a more useful level, Appendices F - I show regression equation parameters for each area in steps one through five and step ten only. Stepwise presentations of variables added are limited to the first five steps while increases in squared multiple correlation, R^2, are shown in the first five steps plus step ten and the final step in Tables 3, 5, 7, 9, and 11. The criterion variable in each of the following multiple regression equations was the score on the qualifying examination in the academic area being shown.

Multiple Regression of Educational Administration

As can be seen in Table 3 the maximum attained multiple R^2 for expressing outcome scores in educational administration was .19. This value was reached in 72 steps and indicated that approximately 19 percent of the variation in the qualifying examination scores for this academic area was accounted for in terms of the independent variables. The maximum predictability of educational administration relative to the other areas on the qualifying examination can be viewed in Appendix E.

TABLE 3

Increases in R^2 for the Multiple Regression Analysis of Educational Administration

Step	Variable Entered	R	R^2	Increase in R^2	F to Enter
1	Post-Admission Graduate Honor Point Average	.22**	.05	.05	36.76
2	Major Department Educational Administration	.28**	.08	.03	23.65
3	Advanced Test of GRE	.31**	.09	.01	11.32
4	Square of Age	.32**	.10	.01	6.02
5	High School Attended in Florida	.33**	.11	.01	5.51
10	--	.36**	.13	.02	3.33
72 (Final)	--	.44**	.19	.06	.01

**$p < .01$

Comparison of the data in Tables 3, 5, 7, 9, and 11 indicated that a reasonable equation for the multiple prediction of outcome in each academic area of the qualifying examination was attained in three steps of regression. Beyond the third step, increases in R^2 were reduced to .01 in all cases. The three-variable equation for educational administration was written from Appendix F, Step 3, as follows:

Educational Administration Score =

+1.0207

+ .0012 (Advanced Test of GRE)

+ .2528 (Major Department Educational Administration)

+ .4587 (Post-Admission Graduate Honor Point Average)

Interpretation of regression equations must be approached with caution because of various limiting factors. These factors are discussed in Chapter V. It is possible, however, to say that, although this equation did not represent a unique three-variable combination relationship with the criterion, it did represent a maximum relationship. That is to say, the multiple correlation, R, was the maximum possible between the educational administration outcome measure and any combination of three of the investigated measures of selecting and training doctoral students.

Thus the equation above was useful in that it gave an optimum three-variable combination for prediction of the criterion variable. It was incorrect, however, to assume that the variables included in this equation were necessarily those most highly correlated on an individual basis with the outcome measure. Each independent variable in this equation was more realistically viewed as a representative of a complex of variables or a factor.

This was so because the basis for selection of new variables at each step of regression was the variable which had the highest partial correlation with the dependent variable partialed on the variables which had already been added. Thus, the variables in the equation had a relatively low intercorrelation, but may each be conceived of as representing other potential variables with which their intercorrelation was relatively high (Guilford, 1956).

In order then to give a broader perspective to the variables in the equation, their intercorrelation with the ten highest criterion correlates from among all the study variables is shown in Table 4. The greatest zero order correlation in each row was indicated so that the ten row correlates were clustered with the three equation variables by column.

Examination of the data thusly tabled reflected generally that a combination of three factors appeared to have been related to success on the outcome measure in educational administration. These factors were:

(a) grades in doctoral study,

(b) orientation toward the ideas of the Educational Administration Department, and

(c) prior academic achievement as indicated by GRE score.

Multiple Regression of Curriculum and Instruction

By referring to Table 5, it can be seen that a maximum R^2 of .20 was reached in predicting the curriculum and instruction portion

TABLE 4

Intercorrelation of Predictor Variables and Criterion Correlates for the Educational Administration Portion of the Qualifying Examination

Criterion Correlates	Regression Equation Variables			
	Educational Administration Criterion	Post-Admission Graduate Honor Point Average	Major Department Educational Administration	Advanced Test of GRE
Educational Administration Criterion	100	27**	26**	18**
Post-Admission Graduate Honor Point Average	27**	100[a]	21**	20**
Major Department Educational Administration	26**	21**	100[a]	-02
Quality Points in Educational Administration Courses	23**	15**	84[a]**	-07
Quarter Hours of Educational Administration Courses	22**	13*	82[a]**	-07

Advanced Test of GRE	18**	20**	-02	100[a]
Honor Point Average in Educational Administration Courses	15**	30[a]**	23**	13**
Quarter Hours of Psychological Foundations Courses	-15**	-22*	-39[a]**	-06
Major Department Counselor Education	-15**	-19**	-34[a]**	-05
Quality Points in Psychological Foundations Courses	-14**	-19**	-40[a]**	-05
Fellowship Held	13**	26[a]**	20**	17**

Note - Decimal points have been omitted.

[a]Highest correlation in the row in absolute terms

*$p < .05$

**$p < .01$

TABLE 5

Increases in R^2 for the Multiple Regression Analysis of Curriculum and Instruction

Step	Variable Entered	R	R^2	Increase in R^2	F to Enter
1	Post-Admission Graduate Honor Point Average	.21**	.04	.04	32.02
2	Major Department Curriculum and Instruction	.25**	.06	.02	13.84
3	Verbal Aptitude Test of GRE	.26**	.07	.01	5.71
4	MAT Score	.29**	.08	.01	10.71
5	Graduation Rate Factor for Undergraduate Degree Institution	.30**	.09	.01	6.63
10	--	.35**	.12	.03	3.73
79 (Final)	--	.45**	.20	.08	. ,01

**p < .01

of the qualifying examination. Thus, approximately 20 percent of the variation in the outcome scores was accounted for in 79 steps. Appendix E shows the predictability of curriculum and instruction relative to the other academic areas on the examination.

From the prior comparison of Tables 3, 5, 7, 9, and 11, three-variable equations were selected for exposition in all academic areas. The three-variable equation for the curriculum and instruction area was written from Appendix G, Step 3, as follows:

Curriculum and Instruction Score =

+ .1810
+ .0008 (Verbal Aptitude Test of GRE)
+ .2090 (Major Department Curriculum and Instruction)
+ .7111 (Post-Admission Graduate Honor Point Average)

The variables in this regression equation were given more definition by referring to Table 6. This table shows the intercorrelation between the three variables in regression and the ten study variables which correlated most highly with the criterion. By observing the variables marked in each column, a crude indication of the factors represented by the equation variables at the top of each column was obtained. Broadly speaking, a combination of three selection and training factors seemed to have been related to the outcome measure in Curriculum and Instruction. The factors were:

(a) grades in doctoral study,

TABLE 6

Intercorrelation of Predictor Variables and Criterion Correlates for the Curriculum and Instruction Portion of the Qualifying Examination

Criterion Correlates	Regression Equation Variables: Curriculum and Instruction Criterion	Post-Admission Graduate Honor Point Average	Major Department Curriculum and Instruction	Verbal Aptitude Test of GRE
Curriculum and Instruction Criterion	100	26**	16**	14**
Post-Admission Graduate Honor Point Average	26**	100[a]	01	17**
Quality Points in Curriculum and Instruction Courses	18**	17**	70[a]**	-04
Quarter Hours in Curriculum and Instruction Courses	16**	13*	71[a]**	-05
Major Department Curriculum and Instruction	16**	01	100[a]	00

Honor Point Average in Curriculum and Instruction Courses	16**	37[a]**	07	06
Verbal Aptitude Test of GRE	14**	18**	01	100[a]
Quarter Hours in Psychological Foundations Courses	-14**	-22**	-47[a]**	-03
Remedial Study for Qualifying Examination	-14**	-27[a]**	-03	-13*
Major Department Counselor Education	-13**	-19**	-38[a]**	-04
Quality Points in Psychological Foundations Courses	-13**	-19**	-47[a]**	-02

Note - Decimal points have been omitted

[a]Highest correlation in the row in absolute terms

*$p < .05$

**$p < .01$

(b) orientation toward the ideas of the Curriculum and Instruction Department, and

(c) verbal aptitude as indicated most effectively by GRE score.

Multiple Regression of Historical and Philosophical Foundations

Table 7 shows that approximately 29 percent of the variation in outcome scores for this academic area was accounted for in 89 steps by a combination of the study variables. Appendix E allows a comparison of this academic area with the other areas in the degree to which multiple prediction was possible from these variables.

As was previously mentioned, based on a comparative examination of Tables 3, 5, 7, 9, and 11, a three-variable equation was selected for further discussion. From Appendix H, Step 3, the three-variable equation for the multiple prediction of the historical and philosophical portion of the qualifying examination was as follows:

Historical and Philosophical Foundations Score =

-1.5253

+ .0017 (Verbal Aptitude Test of GRE)

+1.0864 (Post-Admission Graduate Honor Point Average)

- .0001 (Square of Age)

Additional meaning was given to the equation variables by perusing Table 8. Speaking generally, a combination of the following three factors appeared to have been related to the outcome measure in this academic area:

TABLE 7

Increases in R^2 for the Multiple Regression Analysis of Historical and Philosophical Foundations

Step	Variable Entered	R	R^2	Increase in R^2	F to Enter
1	Post-Admission Graduate Honor Point Average	.34**	.11	.11	91.26
2	Verbal Aptitude Test of GRE	.39**	.15	.04	33.47
3	Square of Age	.41**	.17	.02	10.40
4	Pre-Admission Graduate Honor Point Average	.42**	.18	.01	9.91
5	Major Department Special Education	.43**	.19	.01	9.04
10	--	.47**	.22	.03	3.64
89 (Final)	--	.54**	.29	.07	.01

**p < .01

TABLE 8

Intercorrelation of Predictor Variables and Criterion Correlates for the Historical and Philosophical Foundations Portion of the Qualifying Examination

Criterion Correlates	Regression Equation Variables: Historical and Philosophical Foundations Criterion	Post-Admission Graduate Honor Point Average	Verbal Aptitude Test of GRE	Square of Age
Historical and Philosophical Foundations Criterion	100	40**	30**	-18**
Post-Admission Graduate Honor Point Average	40**	100[a]	18**	-08
Verbal Aptitude Test of GRE	30**	18**	100[a]	-07
Square of Verbal Aptitude Test of GRE	28**	16**	99[a]**	-05
Advanced Test of GRE	26**	20**	39[a]**	02

Honor Point Average in Social Foundations Courses	25**	22**	27[a]**	-14**
Honor Point Average in Historical and Philosophical Foundations Courses	24**	34[a]**	14**	-04
Honor Point Average in Educational Administration Courses	21**	30[a]**	10	00
Pre-Admission Graduate Honor Point Average	20**	19[a]**	05	01
Remedial Study for Qualifying Examination	-19**	-27[a]**	-13*	07
Fellowship Held	18**	26**	30[a]	-01

Note - Decimal points have been omitted

[a]Highest correlation in the row in absolute terms

*$p < .05$

**$p < .01$

(a) grades in doctoral study,

(b) verbal aptitude as indicated most effectively by GRE score, and

(c) age.

Two points should be noted in regard to the age factor. First, younger students performed better than older ones. Second, a quadratic function was a better statement than a linear for expressing the relationship between age and performance.

Multiple Regression of Psychological Foundations

The data in Table 9 show than an R^2 of .22 was obtained in 76 steps in the multiple prediction of the psychological foundations section of the qualifying examination. This value was the maximum possible with the study variables and indicated that they accounted for about 22 percent of the variation in the criterion scores. Appendix E compares the degree of predictability of this academic area from the study variables with the predictability of the other areas of the qualifying examination.

In keeping with an earlier assessment of Tables 3, 5, 7, 9, and 11, a three-variable prediction system for outcome scores in psychological foundations is shown. From Appendix I, Step 3, a three-variable equation for the multiple prediction of this area was written:

Psychological Foundations Score =

+ .9935

- .1205 (Graduation Rate Factor for Institution where Freshman English Taken)

TABLE 9

Increases in R^2 for the Multiple Regression Analysis of Psychological Foundations

Step	Variable Entered	R	R^2	Increase in R^2	F to Enter
1	Post-Admission Graduate Honor Point Average	.18**	.03	.03	25.03
2	Honor Point Average in Social Foundations Courses	.24**	.06	.03	16.00
3	Graduation Rate Factor for the Institution Where Freshman English Taken	.28**	.08	.02	16.63
4	Square of Age	.30**	.09	.01	7.91
5	Sex	.31**	.10	.01	8.75
10	--	.37**	.14	.04	4.97
76 (Final)	--	.47**	.22	.07	.05

**$p < .01$

+ .2875 (Honor Point Average in Social Foundations Courses)

+ .5553 (Post-Admission Graduate Honor Point Average)

The meaning of the variables in this equation was enhanced by referring to Table 10. From the measures of training and selecting doctoral students included in the present study, it appeared that a combination of three general factors related to success on the psychological foundations outcome measure. These factors were:

(a) grades in doctoral study,

(b) performance in social foundations courses, and

(c) the type of institution attended for early years of undergraduate study.

Two observations were in order regarding the nature of this last factor. In the first place, there was a high correlation (.74) between the graduation rate indexes for the first two and last two years of undergraduate study. The high correlation between the two was probably because many students stayed at the same institution for four years. Secondly, it was noted that the graduation rate index was negatively related to the criterion for this area. This meant that students from undergraduate institutions with low graduation rates did less well on the psychological foundations criterion.

Multiple Regression of Social Foundations

It can be seen from Table 11 that approximately 20 percent of the score variation in the social foundations section of the qualifying

TABLE 10

Intercorrelation of Predictor Variables and Criterion Correlates for the Psychological Foundations Portion of the Qualifying Examination

Criterion Correlates	Regression Equation Variables			
	Psychological Foundations Criterion	Post-Admission Graduate Honor Point Average	Honor Point Average in Social Foundations Courses	Graduation Rate Factor for Institution where Freshman English Taken
Psychological Foundations Criterion	100	22**	21**	-18**
Post-Admission Graduate Honor Point Average	22**	100[a]	22**	-06
Honor Point Average in Social Foundations Courses	21**	22**	100[a]	05
Honor Point Average in Psychological Foundations Courses	19**	23[a]**	19**	00
Graduation Rate Factor for Institution where Freshman English Taken	-18**	-06	05	100[a]

Advanced Test of GRE	16**	20[a]**	12*	01
Graduation Rate Factor for Institution Granting Baccalaureate Degree	-16**	-04	02	74[a]**
Pre-Admission Graduate Honor Point Average	16**	19**	25[a]**	01
Remedial Study for Qualifying Examination	15**	-27[a]**	-12**	07
Honor Point Average in Educational Administration Courses	15**	30[a]**	11*	00
Square of Age	-14**	-08	-14[a]**	-08

Note - Decimal points have been omitted

[a]Highest correlation in the row in absolute terms

*p $<$ .05

**p $<$ .01

TABLE 11

Increases in R^2 for the Multiple Regression Analysis of Social Foundations

Step	Variable Entered	R	R^2	Increase R^2	F to Enter
1	Post-Admission Graduate Honor Point Average	.25**	.06	.06	48.33
2	Undergraduate Honor Point Average for the First Two Years Times the Selectivity Factor for the Institution Where Freshman English Taken	.28**	.08	.02	10.32
3	Verbal Aptitude Test of GRE	.29**	.09	.01	7.01
4	Number of Changes in Undergraduate Study	.30**	.09	.00	4.75
5	Quality Points in Educational Administration Courses	.31**	.10	.01	4.58
10	--	.35**	.12	.02	2.74
76 (Final)	--	.45**	.20	.08	.03

**p $<$ .01

examination was accounted for in 76 regression steps. A comparison of the predictability of this academic area relative to the other four areas is shown in Appendix E. As can be noted in Table 11 only small increases (less than .01) in R^2 resulted from the addition of each variable past the third. Therefore, a three-variable equation is discussed. The following three-variable equation was written from Appendix J, Step 3:

Social Foundations Score =

+ .2724
+ .0007 (Verbal Aptitude Test of GRE)
+ .6616 (Post-Admission Graduate Honor Point Average)
+ .0142 (Undergraduate Honor Point Average for the First Two Years Times the Selectivity Factor for the Institution Where Freshman English Taken)

In order to provide a somewhat rough interpretation of the variables in the equation above, Table 12 was consulted. The intercorrelations in this table give a suggestion of possible factors represented by the variables in regression. Additional correlates of each equation variable were indicated in the appropriate column.

In terms of the investigated measures of selecting and training doctoral students, a combination of three factors was related to the social foundations outcome measure. These three factors were:

(a) grades in doctoral study,

TABLE 12

Intercorrelation of Predictor Variables and Criterion Correlates for the Social Foundations Portion of the Qualifying Examination

Criterion Correlates	Regression Equation Variables: Social Foundations Criterion	Post-Admission Graduate Honor Point Average	Undergraduate Honor Point Average for First Two Years Times Appropriate Selectivity Factor	Verbal Aptitude Test of GRE
Social Foundations Criterion	100	32**	22**	20**
Post-Admission Graduate Honor Point Average	32**	100[a]	21**	18**
Undergraduate Honor Point Average for First Two Years Times Appropriate Selectivity Factor	22**	21**	100[a]	19**
Undergraduate Honor Point Average for First Two Years Times Appropriate Selectivity Factor	21**	20**	61[a]**	17**

Verbal Aptitude Test of GRE	20**	18**	19**	100[a]
Square of Verbal Aptitude Test of GRE	19**	16**	19**	99[a]**
Advanced Test of GRE	18**	20**	14**	39[a]**
Undergraduate Honor Point Average for First Two Years	18**	21**	55[a]**	17**
Undergraduate Honor Point Average for First Two Years Times Appropriate Graduation Rate Factor	17**	16**	88[a]**	17**
Miller Analogies Test Score	17**	10	19**	50[a]**
Pre-Admission Graduate Honor Point Average	15**	19[a]**	15**	5

Note - Decimal Points have been omitted

[a]Highest correlation in the row in absolute terms

*$p < .05$

**$p < .01$

(b) undergraduate grades, especially when weighted by admissions selectivity of the undergraduate institution, and

(c) verbal aptitude as indicated most effectively by GRE score.

Hierarchical Clustering

As was explained in the study design, the intercorrelation between outcome expectations of the five academic areas of the qualifying examination was somewhat low (Table 2). This being the case, greater overall predictive power was achieved by developing a separate equation for predicting each area rather than developing one equation for predicting their average. It was also useful, however, to determine the extent and pattern of predictive agreement in outcome measures between the five areas on the qualifying examination. The technique used for this purpose was a hierarchical clustering procedure called JAN.

In the JAN grouping technique, the first step was to determine a single squared multiple correlation value which indicated the overall predictive efficiency obtained when separate regression equations were used for each area. In the second step, each equation was compared with every other equation to determine which two could be combined with the minimum loss of predictive ability. At the completion of step two, the total number of equations in the system was reduced by one and a new overall squared multiple correlation was computed. The single equation which replaced two of the original equations best

represented, in terms of the predictor variables, the joint outcome expectations of the two academic areas clustered. This clustering procedure was continued in a stepwise manner until a single prediction equation was generated to express the combined outcome expectations of all academic areas with as little loss of predictive ability as possible.

An important feature of this clustering technique was that patterns of agreement in outcome expectations of the academic areas could be observed. Examination of the loss in overall predictive efficiency at the various stages of the grouping process helped to identify the number and composition of agreement clusters between the academic areas. Results of the clustering procedure applied to the five equations reported in the last section are presented in the following discussion.

As can be seen in Table 13, the overall predictive ability of the five-equation system expressed in squared multiple correlation, R^2, was .22. This R^2 value reflected the approximate percentage of prediction possible with the five-equation system. It is important to note that this R^2 value indicated the average ability of the system to predict the outcome of the qualifying examination in any individual academic area. Results of each subsequent step of clustering were also shown in Table 13.

The method for analyzing the groupings was to look for breaks in the overall R^2 value as increasingly dissimilar areas were clustered. This method was outlined by Ward & Hook (1963). Applying this method to the data presented in Table 13 seemed to indicate that optimum

TABLE 13

Stages of Hierarchical Clustering for the Academic Areas of the Qualifying Examination

Stage	Academic Areas	R^2
1	Administration Curriculum Psychological Social Historical-Philosophical	.22
2	(Administration, Social) Curriculum Psychological Historical-Philosophical	.18
3	(Administration, Social, Curriculum) Psychological Historical-Philosophical	.14
4	(Administration, Social, Curriculum, Psychological) Historical-Philosophical	.08
5	(Administration, Social, Curriculum, Psychological, Historical-Philosophical)	.02

prediction of the outcome measure in each academic area in terms of the study variables required a rather unique equation. Though the effects are only slight, however; discontinuities in the R^2 function after the first two groupings were somewhat greater. This suggested some possibility for jointly expressing the outcome expectations of three academic areas, educational administration, social foundations of education, and curriculum and instruction in terms of the independent variables. The two remaining academic areas, psychological foundations and personnel services, and historical and philosophical foundations of education each appeared to represent a more clearly separate and distinct set of outcome expectations.

An important point to note in this clustering procedure was that the order of joining the cluster was independent of any question of validity of outcome expectation. For example, to assume that the outcome expectations of the historical and philosophical foundations area were in some way less valid because this area was last to be clustered, is unwarranted. To illustrate this point, the outcome measure in historical and philosophical foundations was found most highly correlated with 11 of the 15 indicators of academic success shown in Table 14.

If the clustering procedure was continued until one single "best" equation for simulating all outcome expectations was produced, the final R^2 value was .02. This value represented the average ability of the one equation to predict the outcome expectations in all areas. At the same time, however, this equation predicted the average of all outcome expectations with an R^2 of .37. To the extent that a

TABLE 14

Correlation[a] of Fifteen Indicators of Academic Success with the Criteria from Each Academic Area of the Qualifying Examination

	Educational Administration	Curriculum and Instruction	Historical & Philosophical Foundations	Psychological Foundations	Social Foundations
Verbal Aptitude Test of GRE	12**	14**	30**	10**	20**
Quantitative Aptitude Test of GRE	08*	08*	07*	-05	02
Advanced Test of GRE	18**	06	26**	16**	18**
MAT Score	08*	-03	13**	04	09*
Undergraduate Honor Point Average for the First Two Years of Study	06	13**	08*	-01	18**
Undergraduate Honor Point Average for the Last Two Years of Study	07*	09*	09*	02	14**
Honor Point Average in Freshman English	01	10**	16**	06	13**

Graduate Honor Point Average Prior to Admission	03	02	20**	16**	15**
Honor Point Average in Educational Administration	15**	09**	21**	15**	10**
Honor Point Average in Psychological Foundations	09*	05	11**	19**	00
Honor Point Average in Social Foundations	04	13**	25**	21**	14**
Honor Point Average in Historical & Philosophical Foundations	08*	03	24**	12**	14**
Honor Point Average in Curriculum & Instruction	10*	16**	12**	07*	15**
Graduate Honor Point Average After Admission	27**	26**	40**	22**	32**
National Teacher's Examination (Common Score)[b]	04	04	18	09	17

[a]Note - Decimal points have been omitted

[b]Note - Not a study variable, based on an N of 39

*$p < .05$

**$p < .01$

doctoral student was judged as passing or failing the qualifying examination in the past by the average of all academic areas (see Appendix A), this single equation was a useful one.

For expository purposes, a decision was made to present only a five-variable equation for the joint prediction of all areas. This decision was based on the observation that beyond the fifth step of regression increases in R^2 for each additional step were relatively small (Table 15). A five-step equation which produced an R^2 of .26 was written from Appendix K, Step 5, as follows:

Average Score on the Qualifying Exam =

+ .4741
+ .0006 (Verbal Aptitude Test of GRE)
+ .0008 (Advanced Test of GRE)
- .0647 (Graduation Rate Factor for Undergraduate Degree Institution)
+ .7054 (Post-Admission Graduate Honor Point Average)
- .0001 (Square of Age)

Predictive Qualities of Three Subsets

As mentioned in the introduction to this chapter, the predictive qualities of each of three subsets of variables are discussed in this section. First, a multiple prediction system generated from the subset of pre-admission variables is presented. Then, from the subset of post-admission variables, a second equation is shown. Next, a third multiple regression equation derived from the subset of program variables is given. The predictive significance of each of these

TABLE 15

Increases in R^2 for the Multiple Regression Analysis
for the Joint Prediction of All Areas
of the Qualifying Examination

Step	Variable Entered	R	R^2	Increase in R^2	F to Enter
1	Post-Admission Graduate Honor Point Average	.42**	.18	.18	152.61
2	Verbal Aptitude Test of GRE	.46**	.21	.03	27.50
3	Square of Age	.47**	.23	.02	16.48
4	Graduation Rate Factor for Undergraduate Degree Institution	.49**	.23	.01	18.47
5	Advanced Test of GRE	.51**	.26	.02	13.35
10	--	.54**	.29	.03	5.82
72 (Final)	--	.61**	.36	.07	.02

**p < .01

subsets of variables in the single "best" overall equation developed in the last section is also given.

Multiple Prediction with Pre-Admission Variables

The 53 pre-admission variables identified in Table 1 and Appendix C were developed into a separate multiple regression equation to determine the predictive ability of this subset alone. From Table 16 it can be seen that a maximum R^2 of .27 was obtained with this group of variables in 54 steps. Also in Table 16, an R^2 of .16 was shown for a five-variable equation. The equation was written from Appendix L, Step 5, as follows:

Average Score on the Qualifying Examination =

+1.1456

- .00001 (Square of Verbal Aptitude Test of GRE)

+ .0066 (Verbal Aptitude Test of GRE)

+ .0013 (Advanced Test of GRE)

- .0730 (Graduation Rate Factor for Undergraduate Degree Institution)

- .0001 (Square of Age)

This equation represented the maximum relationship which could be obtained between the average outcome on the qualifying examination and a five-variable combination from the pre-admission subset. Using the variance ratio test for statistical significance, the ability of this subset of variables alone to effectively predict the criterion was found significant at the .01 level.

TABLE 16

Increases in R^2 for the Multiple Regression Analysis of the Subset, Pre-Admission Variables, in Prediction of All Areas of the Qualifying Examination

Step	Variable Entered	R	R^2	Increase in R^2	F to Enter
1	Verbal Aptitude Test of GRE	.25**	.06	.06	46.15
2	Advanced Test of GRE	.30**	.09	.03	20.51
3	Square of Verbal Aptitude Test of GRE	.34**	.12	.03	22.84
4	Square of Age	.37**	.14	.02	17.61
5	Graduation Rate Factor for Undergraduate Degree Institution	.40**	.16	.02	21.77
10	--	.46**	.21	.05	2.91
54[a] (Final)	--	.52**	.27	.06	0.01

[a]Note - A total of 53 independent variables were considered for entrance into the final regression equation

**$p < .01$

Multiple Prediction with Post-Admission Variables

In Table 1 and Appendix C, ten post-admission variables were listed. When only these variables were considered in the multiple prediction of the average outcome on the qualifying examination, a maximum R^2 of .19 was attained in seven steps (Table 17). It can be seen that virtually all of the predictive ability was accounted for in one step of regression. A one-variable equation had an R^2 of .18 and was written as below from Appendix M, Step 1:

Average Score on the Qualifying Examination =

+ .2660

+ .8383 (Post-Admission Graduate Honor Point Average)

From the post-admission subset of variables, prediction of the average outcome of all areas of the qualifying examination was significant at the .01 level. The equation above represented an optimum prediction system based on one of the post-admission variables.

Multiple Prediction with Program Variables

Multiple regression analysis of the 15 program variables shown in Table 1 and Appendix C resulted in a maximum R^2 of .17 (Table 18). Beyond the third step, however, each additional variable added very little to the three-predictor R^2 value of .09. Appendix N, Step 3, shows the following equation for the first three steps of regression analysis:

TABLE 17

Increases in R^2 for the Multiple Regression Analysis of the Subset, Post-Admission Variables, in Prediction of All Areas of the Qualifying Examination

Step	Variable Entered	R	R^2	Increase in R^2	F to Enter
1	Post-Admission Graduate Honor Point Average	.42**	.18	.18	152.61
2	Remedial Study for Qualifying Examination	.43**	.18	.00	7.13
3	Fellowship Held	.44**	.19	.01	4.27
4	Major Department Special Education	.44**	.19	.00	1.86
5	Major Department Educational Administration	.44**	.19	.00	1.07
7[a] (Final)	--	.44**	.19	.00	.29

[a]Note - A total of 10 independent variables were considered for entrance into the final regression equation

**$p < .01$

TABLE 18

Increases in R^2 for the Multiple Regression Analysis of the Subset, Program Variables, in Prediction of All Areas of the Qualifying Examination

Step	Variable Entered	R	R^2	Increase in R^2	F to Enter
1	Honor Point Average in Social Foundations	.24**	.06	.06	42.90
2	Honor Point Average in Educational Administration	.30**	.09	.03	24.20
3	Honor Point Average in Curriculum and Instruction	.31**	.10	.01	7.51
4	Honor Point Average in Psychological Foundations	.32**	.10	.00	4.95
5	Quality Points in Curriculum and Instruction	.33**	.11	.01	5.24
10	--	.36**	.13	.02	2.72
19[a] (Final)	--	.41**	.17	.04	.03

[a]Note - A total of 15 independent variables were considered for entrance into the final regression equation

**p < .01

Average Score on the Qualifying Examination =

+1.5241

+ .2045 (Honor Point Average in Educational Administration Courses)

+ .1833 (Honor Point Average in Social Foundations Courses)

+ .1080 (Honor Point Average in Curriculum and Instruction Courses)

The three-variable combination above allowed the maximum three-variable prediction of the average qualifying examination score from the program variables. The predictive ability of the subset of variables above was found significant at the .01 level.

CHAPTER V

DISCUSSION

It should be remembered that the design of the study centered around developing a multiple prediction equation for each of five academic areas of the doctoral qualifying examination and then combining these equations in a stepwise hierarchical manner. It was anticipated that the significance of the study would be the production of accountability information suitable for local policy making and input to national level information systems. Discussion of the results includes: limitations, observations, and implications of this study. A chapter summary is also provided.

Limitations of the Study

Since the primary statistical tool of the present study was regression analysis, it is very appropriate to review limiting factors of this technique. One factor which should be remembered is the maximizing nature of the R statistic. Guilford (1956) and Schenck & Naylor (1968) have cautioned about this characteristic of R. A second factor to be considered is the dependency of the outcome of any prediction equation on the particular predictor variables investigated. A third limitation is the extent to which the study results can be generalized beyond the study population.

Although the R values in this study are no doubt inflated in terms of prediction, they are quite useful for making relative comparisons. Comparisons in R between the various areas of the qualifying examination internal to this study have already been noted and can be viewed in Appendix E. Another type comparison which can be made is with other studies using a statistical approach similar to the present study. The multiple correlations obtained in the present study fell in the same general range as those of similar studies (Dawes, 1971; Houston & Roscoe, 1968; Platz, 1959; Robertson & Nielsen, 1961; Talbott, 1966; Williams et al., 1969). In each of these studies, multiple prediction of an outcome measure in graduate study resulted in R values ranging from .36 to .64. The maximum R values reported in the results of the present study ranged from .41 to .61 and were highly significant statistically.

One possibility as to why the R values presented have not compared even more favorably with those of other studies is that study design limitations on the types of variables investigated prevented greater predictive efficiency. For example, the absence of psychological data such as measures of interest, self-concept, and motivation resulted in an obvious shortcoming in the study variables. Failure to include such variables in the design of the study naturally eliminated them from the prediction equations.

As was previously noted, the statistical model for this study was the fixed-effects model. Generalization beyond the study population is usually considered not possible with this model since the independent variables need not be normally distributed. Christal (1968b)

suggested that a prediction equation can hold up even if the predictors are not normally distributed. For three additional reasons, the results of the present study can be considered reasonably generalizable.

One reason stems from the nature of the study population. The population was relatively large, highly selected, and drawn over a seven-year period. A second reason is the stability of the graduate program, faculty, and institution. On the basis of this reason, the study results should at least generalize to future students in the University of Florida College of Education. The third reason, a purely statistical one, is that the number of study cases exceeded the number of predictor variables by a ratio of over 9 to 1.

Observations of the Study

In drawing together observations made in this study, two levels were examined. The first level is reported as observations about the prediction equations. The second level of observations reported deals with some specific study variables.

Observations about the Prediction Equations

The five equations which were developed to predict each of the academic areas of the qualifying examination were interesting in both their similarities and their contrasts. The most obvious similarity among these equations was the consistency and prominence of grades in doctoral study as a predictor variable. The importance of this variable was reflected in two other equations. The overall equation for prediction of the average score on the qualifying examination was one such equation. The other equation was prediction of the average score from the post-admission subset of variables.

Another similarity was the occurrence of GRE verbal aptitude score as a variable in three of the five equations. Again, this variable appeared in two later equations predicting the average qualifying examination score.

A third similarity of note was between the equations for the educational administration and curriculum and instructions areas. Both of these areas were also separate departments in the College of Education. In each case, majoring in the respective department was a variable of some importance in multiple prediction. This suggested that a student received something purely through contact with his major department that was not reflected in number of hours or grades in departmental courses.

Dissimilarities among the five area equations were obvious simply in the fact that each had a unique combination of predictor variables and coefficient weights. Though this observation can be made by visual inspection of the various equations, the hierarchical clustering procedure added confirmation since little predictive homogeneity was noted among the five equations.

As was previously mentioned, the overall equation for prediction of the average score on the qualifying examination was meaningful because one requirement for passing the examination had been a satisfactory average grade (Appendix A). The equation presented provided a five-variable combination which accounted for about 26 percent of the criterion variance. The fact that the average of all academic areas was more predictable from the study variables than were the individual areas suggested a possible difficulty. It is likely that there was

considerable variation in grading standards among the graders (perhaps also within the graders) of each academic area. These possible variations tended to be averaged out in the joint prediction of all areas.

Prediction of the average score on the qualifying examination by each of three subsets of variables was accomplished primarily to test the predictive role of each subset. The predictive ability of each of these subsets, pre-admission variables, post-admission variables, and program variables, was found significant at the .01 level. The equation produced from each subset was also interesting, however.

The equation produced from pre-admission variables was a relatively convenient five-step system which predicted 16 percent of the variation in the average examination score. This was exclusively from variables available prior to admission for doctoral study.

Predictive importance of the variable, grades in doctoral study, was once more underscored by the post-admission variables equation. This variable alone, properly weighted and with an appropriate constant value, accounted for approximately 18 percent of the variation in the examination average. The equation generated from three of the program variables subset had a predictive efficiency of only 9 percent, but pointed up an interesting trend. In most cases, quality of performance in courses from various academic areas in education was a better predictor of overall success than was the number of courses in these areas.

Observations about the Study Variables

Perhaps as important as which variables were accepted into prediction equations was which variables were not. Variables based on letters of recommendation, undergraduate grades (particularly for the last two years), pre-admission graduate grades, quantitative scores on the GRE, and the categories of holding a fellowship, holding an assistantship, and receiving remedial study for the qualifying examination rather surprisingly showed little prominence in the equations. Some clues as to why were surmised by examining the data in Tables 4, 6, 8, 10, and 12.

With the exception of the quantitative scores on the GRE, when any potential equation variable from these other sources appeared among the highest ten correlates of an area criterion, it also correlated rather highly with an equation variable. All such potential variables, except those based on letters of recommendation, appeared as a high correlate at least once. In almost every case the equation variable which absorbed their effect was grades in doctoral study.

The situation with the quantitative scores of the GRE was shown fairly well in Table 14. Not only was it nonessential in multiple prediction, it showed only a slight individual relationship to all area criteria. Apparently, the skills measured by the Quantitative Aptitude Test of the GRE were not related to desired outcomes in the study population.

One type variable showed up in a somewhat unexpected way in three of the presented equations. The type variable was the graduation rate factor which was used to classify undergraduate institutions on the

basis of the percentage of freshmen they graduate. The main reason for including this factor as a variable was to generate possible interactive effects between undergraduate grades and the type of institution granting the grades. Instead, unexpectedly, the effect was a direct one. Furthermore, the effect worked opposite to the intuitive. As was mentioned in the study results, institutional ratings reflecting a high attrition rate were negatively related to success on the criteria. The effect was not great, but it was persistent.

Possibly something like a categorical variable was being felt since the University of Florida was in the highest attrition rating level. Eighty-three of the 105 cases which received the highest attrition rating for undergraduate institution granting the degree were University of Florida graduates. The meaning of this factor remains questionable even with this information. It is tempting to speculate that some psychological factors may have been operating. A conservative approach suggests the possibilities for further investigation.

A final consideration regarding the study variables is the relevance of the many generated variables. A total of 33 variables were generated by functions of other variables. Of this number, only two showed enough meaning in overall multiple prediction to take note of. The more prominent of the two was the square of age at time of admission. This squared value was a better individual predictor than was age itself. Apparently, a downward opening second order curve was a better representation than a line of the relationship between age and performance.

The other variable of the two was the square of verbal aptitude score on the GRE. Unlike the case with age, the square of the verbal aptitude score was not a better single predictor than the verbal score itself. However, in the equation formed from pre-admission variables only, the square of verbal GRE score did add slightly to multiple prediction.

Based on the rather poor showing of essentially all of the generated variables, their inclusion in the study seems pretty useless in hindsight. Certainly the place of such variables in future studies similar in nature to this study should be viewed with some skepticism.

Implications of the Study

Implications of this study are discussed in rather general terms of accountability. In this respect, concern is directed toward identifying prospects for local policy considerations. Additionally, some mention is made of findings which possibly have wider significance.

The positive relationship between grades in doctoral study and performance on the qualifying examination spoke well for the consistency of faculty expectations. Furthermore, this relationship seemed to provide a rather reliable means for diagnosing difficulty in the course of a doctoral program.

The uniqueness of the prediction equations for the five academic areas suggested the utility of particularized admissions depending on prospective major. This theme was reinforced by the difficulty of clustering the various areas into common prediction systems. Since the average performance on the qualifying examination was reasonably predictable by a combination of five pre-admission variables, some

system such as this seemed an efficient way to make a minimum screening of applicants for admission. Additional, more particularlized admissions screening, based on prospective major, would seem very profitable.

Also in regard to admissions, the minimal relationships found between quantitative score on the GRE and the various criteria seemed noteworthy. Going one step further, the findings of this study would seem to raise a general question as to the meaning of the quantitative score in prediction of success in graduate study programs similar to the one investigated.

As previously noted, the generated variables in this study were essentially nonproductive. Because of the large number of such variables included, their lack of productivity suggested that the procedure of building variables like these may not be worthwhile.

A final consideration was based on the observation that the average score on the qualifying examination was more predictable than any of the individual academic areas. As mentioned, this could be a sign that considerable variation existed in the grading standards of any one area. The evidence for this, however, was not conclusive. Ample doubt was raised to warrant suggesting the possibility of a standardized qualifying examination procedure graded on the basis of normed data.

Summary

In review, limitations of the regression analysis technique were discussed. In spite of the limitations of this technique, it was

concluded that the study results were suitable for internal comparisons and comparisons with the results of other similar studies. It was also concluded that the study results could be reasonably generalized beyond the study population.

Study observations were made about the prediction equations and about the predictor variables. In regard to the prediction equations, both similarities and contrasts were noted in comparing the five area equations. The differences between the prediction equations for the five academic areas were further demonstrated by a difficulty in clustering them into a common prediction system. A practical five-variable equation was produced as an end result of the hierarchical clustering procedure. This equation accounted for 26 percent of the variation in the average qualifying examination score. It was noted that the average of all areas on the qualifying examination was more predictable than any of the separate areas. The predictive qualities of each of the three subsets of variables: pre-admission variables, post-admission variables, and program variables, were highly significant in overall prediction.

In regard to the predictor variables, it was observed that the most consistent and prominent predictor variable was grades in doctoral study. Another predictor variable of importance in multiple prediction was the verbal aptitude score of the GRE. One variable which had a surprisingly poor showing in multiple prediction as well as very little individual relationship to the area criteria was quantitative score of the GRE. The 33 generated variables in general also showed poorly in multiple prediction.

On the basis of the study observations, five implications were cited. First, it was suggested that grades in doctoral study would seem to provide a very reliable means for diagnosing difficulty in the course of a doctoral program. Second, although a general screening process of all applicants for admission could likely be done quite effectively by an equation, the unique prediction equation for each area suggested that further particularized admissions based on prospective major would seem profitable. Third, the predictive meaning of the quantitative score on the GRE in the investigated doctoral program and other similar programs was questioned. Fourth, the utility of generating combination variables in future studies similar to this study seemed doubtful. Finally, the rather good liklihood of considerable variation in standards among the graders in each academic area of the qualifying examination indicated that a standardized testing procedure would be worthwhile.

APPENDICES

APPENDIX A

Procedures Followed by the Qualifying Examination Committee for Administering Examinations

1. The committee meets about four to six weeks before the examinations which are given three times a year (September, January, and June). The exams are started on the Monday following the beginning of classes for each trimester. The main purpose of this meeting is to select persons to prepare questions in the following areas: Curriculum; Psychology, Human Development, and Personnel Services; Sociological Foundations; Administration; Historical and Philosophical Foundations.

2. Two persons are selected for each area by the Qualifying Examination Committee to prepare and serve as readers for their area of specialization. Whenever possible, one of the persons preparing the questions should have worked on the preceding examination. When this is not possible, an effort is made to get at least one veteran of earlier examinations.

3. The persons selected to write examination questions are ordinarily faculty members of the College of Education who have doctor's degrees and are members of the graduate faculty. They are usually asked to write in their field of specialization.

4. After the writing teams are selected, they are notified by the Assistant Dean for graduate studies in education who serves as an ex officio member and secretary to the Qualifying Examination Committee. A

form letter approved by the Committee is sent to each reader and appears as Appendix A to this statement.

5. The names of persons writing questions are kept confidential, both before and after the examinations.

6. Deadlines are named for submitting questions to the Office of the Assistant Dean, College of Education. The Qualifying Examination Committee meets a second time and reviews the questions for clarity, appropriate difficulty, length, etc. Minor modifications or editing may be done by the Committee. Major modifications are not made in the questions without the consent of the writers. The writers may be asked to change the questions, or occasionally, to write new ones. Care is taken to see that there is little overlapping among the questions.

7. The Assistant Dean and the Chairman of the Qualifying Examination Committee later arrange the sequence in which the questions are administered. Usually, a fairly straightforward question is selected for the first question to be administered.

8. The Assistant Dean for graduate work in the College of Education is in charge of administering the examination questions. Each student is assigned a number. This number alone appears on all answers to the questions. Names are revealed only after the papers have been read and evaluated and the Qualifying Examination Committee has made its decisions with regard to a pass or a failure in all instances.

9. The student's answers are sent by confidential folder to the writers of the questions for evaluation, along with a rating sheet and instructions presented as Appendix B. After the readers have read and returned the papers, a member of the committee takes the rating sheets and prepares a profile for each student. The check marks are given

numerical weights--1.0 for the bottom of the scale, 3.0 for the midpoint, and 5.0 for the top. In case of a student who has a profile ranging below 2.70, a second person is asked to carefully examine the numerical weights assigned. The entire committee uses the rating sheets as returned by the readers in making its decision in each case where a student is in the borderline position.

10. A third meeting of the Qualifying Examination Committee is held for each examination period to make final judgment with regard to passing and failing. The Committee has available the rating sheets, a profile of assigned numerical weights, comments made by the readers, and the examination papers. Each case is presented and discussed anonymously. Ordinarily a total numerical score below 2.50 or a score less than this in more than three areas is considered as a failure. A score between 2.50 and 2.70 is generally considered as in a grey zone where a committee judgment is made. The Committee has followed the following procedure in most examinations:

A. A motion is made and seconded and acted upon for those in the opinion of the Committee who have clearly passed the examination.

B. A second motion is acted upon for those clearly failing the examination.

C. Finally, the Committee gives careful consideration and acts individually upon each case which falls between a clear pass or failure. In this consideration the Committee has available and has on numerous occasions inspected the written papers in addition to a consideration of the profiles and comments of the readers. As noted above, no names are revealed until the Committee makes its

final judgment for each case.

11. Students are notified by special delivery letter from the Office of the Assistant Dean, College of Education, immediately following the committee decisions. Information is kept confidential by Committee members.

12. The papers for each student are kept on confidential file in the Office of the Assistant Dean. These files are available for inspection by any interested faculty member on the staff of the College of Education.

APPENDIX B

Student No._____
Question No._____
Reader_____

RATING SCALE FOR THE DOCTORAL QUALIFYING EXAMINATION

Please indicate carefully on the following scale your rating of this paper. It may be helpful to keep in mind that the readers of doctoral examination papers in the College of Education have traditionally been guided by the following criteria, among others:

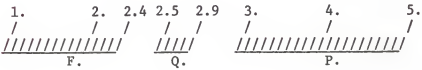
I. Understanding of material and concepts
Indicate familiarity with basic concepts and materials in area; is precise in use of concepts and ideas, avoids use of educational jargon and cliches.

II. Clarity of Expression
Keeps discussion relevant to question; is clear and concise; logical flow of ideas.

III. Evidence of Scholarship
Knows basic sources and major research in area; uses references appropriately; gives facts accurately and cited generalizations correctly.

IV. Critical Mindedness
Supports beliefs with evidence; evaluates sources cited; presents evidence of reflection on reading.

V. Creativity
Is sensitive to ramifications of problems; synthesizes own solutions for problems; shows insight in diagnosis; proposes own solutions.



The Committee suggests that it will be helpful if the faculty will make some comments regarding their appraisal of the paper. This is particularly true where the rating of the paper is in the questionable area. Use the space below for this purpose.
NOTE: The Committee requests that readers not write comments on the body of the students' papers.

REMARKS:

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APPENDIX C

Variables Derived from Combinations of Directly Obtained Variables

Number of Derived Variable	Combining Function	Variables Combined in Derivation
		Source: Pre-Admission Information
46.	Square	GRE verbal score
47.	Square	GRE quantitative score
48.	Product	Undergraduate honor point average for the first two years of study Selectivity factor for institution where Freshman English taken
49.	Product	Undergraduate honor point average for the first two years Selectivity factor for institution where Freshman English taken Graduation rate factor for institution where Freshman English taken
50.	Product	Undergraduate honor point average for the first two years Graduation rate factor for institution where Freshman English taken
51.	Product	Undergraduate honor point average for the last two years Selectivity factor for institution where baccalaureate degree received
52.	Product	Undergraduate honor point average for the last two years Selectivity factor for institution where baccalaureate degree received Graduation rate factor for institution where baccalaureate degree received

53.	Product	Undergraduate honor point average for the last two years Selectivity factor for institution where baccalaureate degree received Graduation rate factor for institution where baccalaureate degree received Undergraduate major in liberal arts
54.	Product	Undergraduate honor point average for the last two years Selectivity factor for institution where baccalaureate degree received Graduation rate factor for institution where baccalaureate degree received Undergraduate major in science or mathematics
55.	Product	Undergraduate honor point average for the last two years Selectivity factor for institution where baccalaureate degree received Graduation rate factor for institution where baccalaureate degree received Undergraduate major in a professional field
56.	Product	Undergraduate honor point average for the last two years Graduation rate factor for institution where baccalaureate degree received
57.	Product	Undergraduate honor point average for the last two years Graduation rate factor for institution where baccalaureate degree received Undergraduate major in liberal arts
58.	Product	Undergraduate honor point average for the last two years Graduation rate factor for institution where baccalaureate degree received Undergraduate major in science or mathematics

Number of Derived Variable	Combining Function	Variables Combined in Derivation
		Source: Pre-Admission Information
59.	Product	Undergraduate honor point average for the last two years Graduation rate factor for institution where baccalaureate degree received Undergraduate major in a professional field
60.	Product	Undergraduate honor point average for the last two years Selectivity factor for institution where baccalaureate degree received Undergraduate major in liberal arts
61.	Product	Undergraduate honor point average for the last two years Selectivity factor for institution where baccalaureate degree received Undergraduate major in science or mathematics
62.	Product	Undergraduate honor point average for the last two years Selectivity factor for institution where baccalaureate degree received Undergraduate major in a professional field
63.	Product	Undergraduate honor point average for the last two years Undergraduate major in liberal arts
64.	Product	Undergraduate honor point average for the last two years Undergraduate major in sicnece or mathematics
65.	Product	Undergraduate honor point average for the last two years Undergraduate major in a professional field
66.	Product	Honor point average in Freshman English Selectivity factor for institution where Freshman English taken

67.	Product	Honor point average in Freshman English Graduation rate factor for institution where Freshman English taken
68.	Product	Honor point average in Freshman English Selectivity factor for institution where Freshman English taken Graduation rate factor for institution where Freshman English taken
69.	Square	Age
70.	Product	Graduate honor point average prior to admission Master's degree in education
71.	Product	Graduate honor point average prior to admission Master's degree received at University of Florida
72.	Product	Graduate honor point average prior to admission Master's degree in education Master's degree received at University of Florida
		Source: Post-Admission Information
73.	Square	Time in doctoral study
		Source: Graduate Program Information
74.	Product	Honor point average in educational administration Total hours of educational administration
75.	Product	Honor point average in psychological foundations Total hours of psychological foundations

Number of Derived Variable	Combining Function	Variables Combined in Derivation
		Source: Graduate Program Information
76.	Product	Honor point average in sociological foundations Total hours of sociological foundations
77.	Product	Honor point average in philosophical and historical foundations Total hours of philosophical and historical foundations
78.	Product	Honor point average in curriculum and instruction Total hours of curriculum and instruction

APPENDIX D

Mean and Standard Deviation of Independent Variables

Variable Number	Variable	Mean	Standard Deviation
1.	GRE verbal score	573.65	81.22
2.	GRE quantitative score	559.39	95.14
3.	GRE advanced score	580.83	60.23
4.	MAT score	60.81	11.72
5.	Undergraduate honor point average for the first two years of study	2.64	.56
6.	Undergraduate honor point average for the last two years of study	2.94	.44
7.	Undergraduate major in liberal arts	.31	.46
8.	Undergraduate major in science or mathematics	.11	.31
9.	Undergraduate major in a professional field	.59	.49
10.	Honor point average in Freshman English	2.62	.77
11.	Number of undergraduate changes	.78	1.04
12.	Selectivity factor for institution where Freshman English taken	5.12	1.32
13.	Selectivity factor for institution where baccalaureate degree received	5.33	1.03

APPENDIX D (continued)

Variable Number	Variable	Mean	Standard Deviation
14.	Graduation rate factor for institution where Freshman English taken	5.91	.94
15.	Graduation rate factor for institution where baccalaureate degree received	6.05	.85
16.	Master's degree in education	.76	.43
17.	Age	35.15	7.78
18.	Sex	.20	.40
19.	Prior military experience	.46	.50
20.	High school graduate in Florida	.31	.46
21.	Years of teaching experience	6.14	5.84
22.	Recommendation ratings prior to admission	4.04	.31
23.	Graduate honor point average prior to admission	3.58	.21
24.	Master's degree received at University of Florida	.49	.50
25.	Time in doctoral study	21.71	18.58
26.	Recommendation ratings after admission	4.07	.28
27.	Major department Foundations	.14	.34
28.	Major department Special Education	.04	.19
29.	Major department Counselor Education	.25	.43
30.	Major department Administration	.27	.44

APPENDIX D (continued)

Variable Number	Variable	Mean	Standard Deviation
31.	Major department Curriculum and Instruction	.31	.46
32.	Remedial study	.11	.32
33.	Graduate honor point average after admission	3.70	.19
34.	Assistantship held	.51	.50
35.	Fellowship held	.40	.49
36.	Honor point average in educational administration	3.73	.29
37.	Honor point average in psychological foundations	3.68	.31
38.	Honor point average in sociological foundations	3.70	.43
39.	Honor point average in philosophical and historical foundations	3.56	.44
40.	Honor point average in curriculum and instruction	3.69	.36
41.	Total hours of educational administration	11.03	11.78
42.	Total hours of psychological foundations	18.31	15.69
43.	Total hours of sociological foundations	3.30	3.31
44.	Total hours of historical and philosophical foundations	4.02	3.58
45.	Total hours of curriculum and instruction	13.06	8.54
46.	Square of number 1	335663.81	93182.88
47.	Square of number 2	321950.94	108887.00

APPENDIX D (continued)

Variable Number	Variable	Mean	Standard Deviation
48.	Product of numbers 5 and 12	13.38	4.32
49.	Product of 5, 12, and 14	78.73	28.18
50.	Product of 5 and 14	15.61	4.19
51.	Product of 6 and 13	15.66	3.72
52.	Product of 6, 13, and 15	94.47	25.85
53.	Product of 6, 13, 15, and 7	28.18	44.60
54.	Product of 6, 13, 15, and 8	9.21	27.82
55.	Product of 6, 13, 15, and 9	57.13	51.69
56.	Product of 6 and 15	17.81	3.63
57.	Product of 6, 15, and 7	5.25	8.21
58.	Product of 6, 15, and 8	1.75	5.19
59.	Product of 6, 15, and 9	10.83	9.39
60.	Product of 6, 13, and 7	4.86	7.62
61.	Product of 6, 13, and 8	1.57	4.71
62.	Product of 6, 13, and 9	9.24	8.20
63.	Product of 6 and 7	.90	1.38
64.	Product of 6 and 8	.30	.87
65.	Product of 6 and 9	1.75	1.50
66.	Product of 10 and 12	13.36	5.27
67.	Product of 10 and 14	15.47	5.32
68.	Product of 10, 12, and 14	78.45	33.12
69.	Square of 17	1295.91	603.17
70.	Product of 23 and 16	2.73	1.55

APPENDIX D (continued)

Variable Number	Variable	Mean	Standard Deviation
71.	Product of 23 and 24	1.79	1.82
72.	Product of 23, 16, and 24	1.53	1.80
73.	Square of 25	815.82	2300.64
74.	Product of 36 and 41	41.64	44.83
75.	Product of 37 and 42	67.96	59.00
76.	Product of 38 and 43	12.14	12.12
77.	Product of 39 and 44	14.53	13.63
78.	Product of 40 and 45	48.52	32.21

APPENDIX E

Maximum Squared Multiple Correlation, R^2, for Each Academic Area of the Qualifying Examination

Area	Number of steps	R	R^2
Educational Administration	72	.44	.19
Curriculum and Introduction	79	.45	.20
Historical and Philosophical Foundations	89	.54	.29
Psychological Foundations	76	.47	.22
Social Foundations	76	.45	.20

APPENDIX F

Data for Multiple Regression of
Educational Administration

Equation Parameter	Stepwise Coefficient Values					
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 10
R	.2216	.2823	.3068	.3190	.3297	.3593
Constant	3.3939	1.4168	1.0207	1.2074	1.2918	1.3532
Variable 3	--	--	.0012	.0012	.0012	.0013
4	--	--	--	--	--	.0036
11	--	--	--	--	--	-.0476
16	--	--	--	--	--	-.1032
20	--	--	--	--	-.1056	-.0929
30	--	.2415	.2528	.2607	.2741	.2807
33	.2908	.5386	.4587	.4317	.4198	.3935
59	--	--	--	--	--	.0041
68	--	--	--	--	--	-.0018
69	--	--	--	-.0001	-.0001	-.0001

APPENDIX G

Data for Multiple Regression of
Curriculum and Instruction

Equation Parameter	Stepwise Coefficient Values					
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 10
R	.2075	.2476	.2623	.2875	.3019	.3489
Constant	.4618	.4129	.1810	.3111	.8475	-.3400
Variable 1	--	--	.0008	.0014	.0014	.0078
4	--	--	--	-.0084	-.0087	-.0092
15	--	--	--	--	-.0779	-.1236
27	--	--	--	--	--	-.1889
31	--	.2099	.2090	.2218	.2194	.1963
33	.7736	.7692	.7111	.7192	.7049	.5990
35	--	--	--	--	--	.1116
46	--	--	--	--	--	.0000
60	--	--	--	--	--	-.0081
67	--	--	--	--	--	.0119

APPENDIX H

Data for Multiple Regression of Historical and Philosophical Foundations

Equation Parameter		Stepwise Coefficient Values					
		Step 1	Step 2	Step 3	Step 4	Step 5	Step 10
R		.3371	.3917	.4070	.4209	.4331	.4674
Constant		-1.3002	-1.8318	-1.5253	-2.5266	-2,2689	-2.4369
Variable	1	--	.0018	.0017	.0017	.0018	.0013
	3	--	--	--	--	--	.0009
	7	--	--	--	--	--	.4557
	10	--	--	--	--	--	.1094
	23	--	--	--	.3633	.3587	.3384
	28	--	--	--	--	-.3843	-.4028
	33	1.2481	1.1151	1.0864	1.0094	.9301	.8980
	50	--	--	--	--	--	-.0127
	53	--	--	--	--	--	-.0035
	69	--	--	-.0001	-.0001	-.0001	-.0002

APPENDIX I

Data for Multiple Regression of
Psychological Foundations

Equation Parameter	Stepwise Coefficient Values					
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 10
R	.1843	.2350	.2772	.2950	.3133	.3720
Constant	.6828	.1754	.9935	1.3735	1.5728	-.2164
Variable 3	--	--	--	--	--	.0012
14	--	--	-.1205	-.1272	-.1284	-.0772
18	--	--	--	.2642	.2157	.2209
23	--	--	--	.5322	--	.3308
33.	.7342	.6024	.5553	--	.5147	.5577
38	--	.2690	.2875	--	.2334	.1886
52	--	--	--	--	--	-.0040
69	--	--	--	-.0001	-.0002	-.0002
76	--	--	--	--	--	-.0050

APPENDIX J

Data for Multiple Regression of
Social Foundations

Equation Parameter	Stepwise Coefficient Values					
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 10
R	.2521	.2774	.2932	.3034	.3129	.3519
Constant	.4341	.4948	.2724	.3253	.2416	.2157
Variable 1	--	--	.0007	.0008	.0007	.0008
11	--	--	--	-.0458	-.0461	-.0523
21	--	--	--	--	--	-.0076
23	--	--	--	--	--	.1707
33	.7809	.7051	.6616	.6580	.6993	.6727
37	--	--	--	--	--	-.1574
45	--	--	--	--	--	.0073
48	--	.0164	.0142	.0118	.0113	.0099
74	--	--	--	--	-.0010	-.0012
77	--	--	--	--	--	.0027

APPENDIX K

Data for Multiple Regression for the Joint Prediction of All Areas of the Qualifying Examination

Equation Parameter	Stepwise Coefficient Values					
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 10
R	.4201	.4552	.4745	.4948	.5087	.5409
Constant	.2660	.0147	.2150	.6796	.4741	-1.0553
Variable 1	--	.0008	.0008	.0008	.0006	.0046
3	--	--	--	--	.0008	.0008
10	--	--	--	--	--	.0401
15	--	--	--	-.0639	-.0647	-.0673
23	--	--	--	--	--	.1457
33	.8383	.7755	.7567	.7418	.7054	.5802
38	--	--	--	--	--	.0719
45	--	--	--	--	--	.0037
46	--	--	--	--	--	.0000
69	--	--	-.0001	-.0001	-.0001	-.0001

APPENDIX L

Data for Multiple Regression of the Subset, Pre-Admission Variables, in Prediction of All Areas of the Qualifying Examination

Equation Parameter	Stepwise Coefficient Values					
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 10
R	.2467	.2953	.3401	.3702	.4035	.4589
Constant	2.6934	2.2275	.3138	.6748	1.1456	.0663
Variable 1	.0012	.0008	.0075	.0066	.0066	.0070
3	--	.0011	.0012	.0013	.0013	.0011
5	--	--	--	--	--	.0690
11	--	--	--	--	--	-.0228
15	--	--	--	--	-.0730	-.0562
16	--	--	--	--	--	-.0532
20	--	--	--	--	--	-.0803
23	--	--	--	--	--	.2584
46	--	--	-.00001	-.00001	-.00001	-.00001
69	--	--	--	-.0001	-.0001	-.0001

APPENDIX M

Data for Multiple Regression of the Subset, Post-Admission Variables, in Prediction of All Areas of the Qualifying Examination

Equation Parameter	Stepwise Coefficient Values					
	Step 1	Step 2	Step 3	Step 4	Step 5	(Final) Step 7
R	.4201	.4297	.4354	.4378	.4392	.4402
Constant	.2660	.4688	.5835	.6564	.6213	.5191
Variable 26	--	--	--	--	--	.0259
27	--	--	--	--	--	-.0289
28	--	--	--	-.0929	-.0994	-.1076
30	--	--	--	--	-.0316	-.0388
32	--	-.1134	-.1125	-.1144	-.1136	-.1090
33	.8383	.7869	.7497	.7309	.7422	.7426
35	--	--	.0567	.0578	.0624	.0642

APPENDIX N

Data for Multiple Regression of the Subset, Program Variables, in Prediction of All Areas of the Qualifying Examination

Equation Parameter	Stepwise Coefficient Values					
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 10
R	.2384	.2964	.3121	.3220	.3321	.3648
Constant	2.5697	1.7639	1.5241	1.2486	1.1872	2.1050
Variable 36	--	.2337	.2045	.1994	.1991	.1658
37	--	--	--	.1007	.1203	-.0214
38	.2148	.1968	.1833	.1711	.1761	.1537
39	--	--	--	--	--	.0447
40	--	--	.1080	.0998	.0788	-.0030
42	--	--	--	--	--	-.0559
43	--	--	--	--	--	-.0064
45	--	--	--	--	--	-.0200
75	--	--	--	--	--	.0147
78	--	--	--	--	.0010	.0063

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BIOGRAPHICAL SKETCH

Joseph Daniel Adams III was born January 16, 1939, in Tampa, Florida, the son of Mr. and Mrs. Joseph D. Adams, Jr. of that city. He attended the public schools of Hillsborough County, Florida, and graduated from H. B. Plant High School in June, 1957.

The following year he enrolled as a freshman at the University of Florida and graduated in 1962 with a Bachelor of Arts degree. After completion of undergraduate study, he entered the United States Air Force. He served in the United States and in Europe as an intelligence officer until September, 1967.

He entered the University of Florida Graduate School in Education and received the Master of Education degree in March, 1969, with major in psychological foundations of education. While studying for his master's degree, he also held a graduate assistantship in the University of Florida Graduate Studies in Education Office.

After receiving his master's degree, he continued his study toward the Doctor of Philosophy degree until the present. While in residence for his advanced degree requirements, he worked for two years as a graduate assistant and one year as a graduate research associate in the University of Florida Graduate Studies in Education Office.

In August, 1971, he was employed at St. Petersburg Junior College as an instructor in the Social Sciences Department. He continued

toward completion of his doctoral degree, studying in absentia, while teaching at St. Petersburg Junior College.

Joseph Daniel Adams III married the former Florence R. Copeland. They are the parents of three children. He is a member of Phi Delta Kappa, Kappa Delta Pi, and the American Educational Research Association.

I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

William W. Purkey, Chairman
Professor of Education

I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Betty L. Siegel
Associate Professor of Education

I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that, in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Dean of the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August, 1972.

Dean, College of Education

Dean, Graduate School